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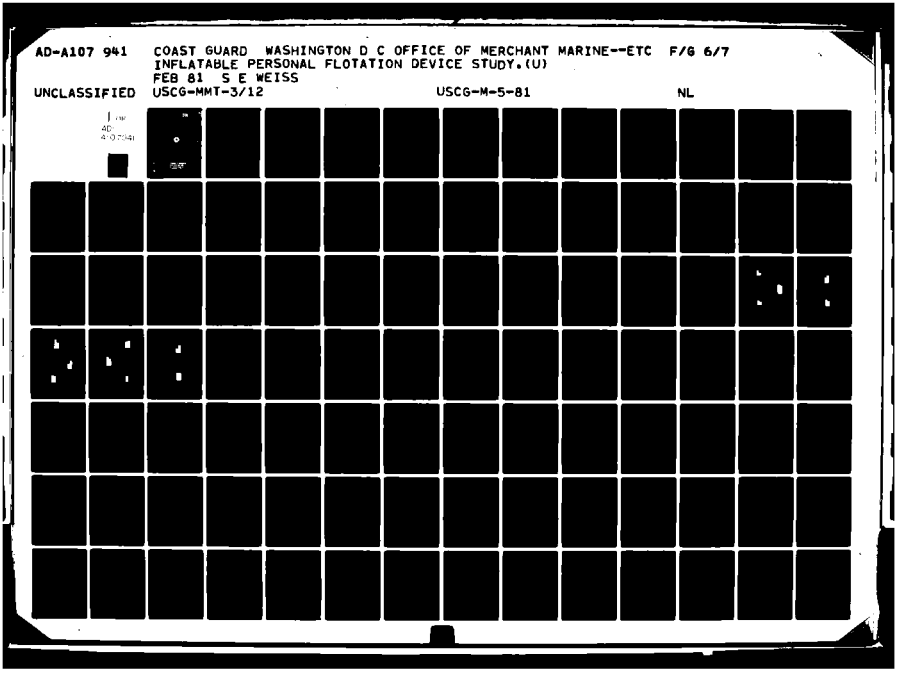

REPORT NO. CG-M-5-81

DEVELOPMENT

INFLATABLE PERSONAL FLOTATION DEVICE STUDY

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OFFICE OF MERCHANT MARINE SAFETY
U.S. COAST GUARD HEADQUARTERS

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FINAL REPORT

PREPARED BY

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16. Abstract

The purpose of this study was to help determine whether the Coast Guard should pursue the development of an approval specification for inflatable PFDs (life jackets). To ascertain the suitability of the inflatable PFD as a lifesaving device, an in-use study was conducted utilizing the Coast Guard Auxiliary. Approximately 550 inflatable PFDs of various diverse configurations and means of inflation were distributed to Auxiliarist volunteers throughout the country at the beginning of the 1979 summer boating season. The Auxiliary participants used the inflatable PFDs as they did their inherently buoyant devices for the summer. Three questionnaires were distributed to them at the beginning, middle and end of the boating season. The Auxiliarists returned their PFDs at the end of the summer for examination.

Results obtained from the analysis of the questionnaires and returned inflatable PFDs show that: (1) respondents would wear four inflatable models "slightly" to "moderately" more than they would their inherently buoyant devices; (2) only one of these four models received a favorable response to more than one of the questions measuring "trust"; (3) the "non-operable" response rate for all inflatables was between 12.5% and 20.1%; and (4) 28% of the respondents had problems servicing their inflatables.

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METRIC CONVERSION FACTORS

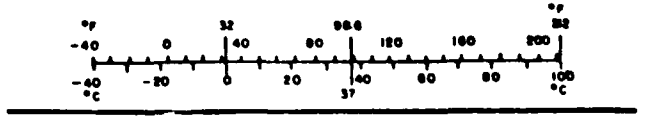
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

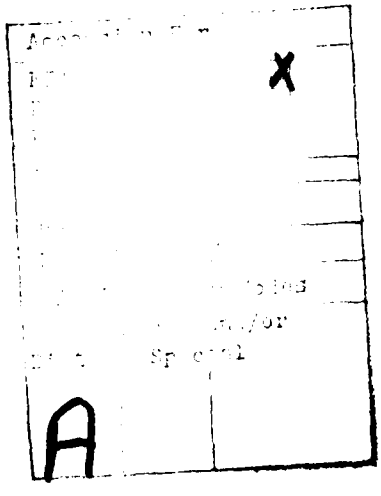
Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



PREFACE

I would like to acknowledge the assistance of Mr. Gary Traub from the Office of Boating, Public and Consumer Affairs for his assistance in the statistical analysis portion of this study.



AUXILIARY INFLATABLE PFD STUDY

ABSTRACT/KEY POINTS

-- By the end of the boating season, the respondents stated that they would wear inflatable devices M, E, J and H slightly to moderately more than they would their inherently buoyant PFDs. When analyzing this statement, keep in mind that the PFDs could be of Types I, II or III. In some cases inflatables were compared with the respondent's Type I or II inherently buoyant devices which are generally less wearable than Type III inherently buoyant devices. This means that some inflatables were not compared to the most wearable inherently buoyant PFD.

-- Of the four devices mentioned above only the M device received a favorable response to more than one of the major "trust" questions. (Q6*, F7a, F6). The M device received a significantly more favorable response to both of the major "trust" questions in which it was analyzed. This device has the highest trust rating by a considerable degree when compared to the other inflatables.

-- Only the M automatic inflation system did well. The dissolvable element was a concern to some users of automatic inflator P.

-- Manual inflators for many brands were similar. All had identical problems such as "failure to recock" and "forgot to change cylinder". The manual portion of automatic inflator P appears to have solved the recocking problem.

-- Some users worried about being unconscious or panicking and therefore not being able to inflate manually or orally.

-- Several devices had leakage problems.

-- The "nonoperable" response rate for all inflatables was between 12.5% and 20.1%.

-- The overall maximum price survey participants would pay for inflatable PFDs is $18.00. The overall average price the Coast Guard paid for these devices for use in this field test was $37.00. These PFDs were purchased at approximately wholesale cost.

-- 28% of respondents had problems with serviceability of the devices.

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INTRODUCTION

In recent years much official attention has been focused on the high number of people involved in boating accidents who are found not to be wearing PFD's at the time of the accident. Drownings in recreational boating totaled 1065 in 1978, 1174 in 1979 and approximately 11,000 from 1970 to 1978. Of these victims, over 75% were not found to be wearing PFD's. In fact, in observational studies of recreational boaters only 7% to 19% of the observed boating population were wearing PFD's.

The explanation for this has centered on the poor aesthetics and lack of comfort of the presently approved PFD's. In work done by Wyle Laboratories in 1977, "wearability" was defined as the probability that a PFD will be worn by a victim at the time he enters the water in a boating accident. Wearability in a practical sense is identified with such things as the bulk, warmth, and style of the device. Past efforts to improve wearability by decreasing bulk have resulted in Type II and Type III devices of the kind presently approved. These devices, because of their inherently buoyant nature suffer a loss of flotation when their bulk is reduced. Wearability of these devices may be marginally improved due to the smaller size and more attractive styling of these devices but even with their wide availability boating drownings number over a thousand each year.

Efforts to improve wearability more dramatically have led to consideration of inflatable devices. Inflatables have been recognized for some time as offering unique capability to reduce the bulk of a PFD without sacrificing flotation characteristics. In fact in recent Coast Guard studies some inflatables were found to be competitive with conventional inherently buoyant devices in performance and wearability. However, the Coast Guard does not now

approve inflatable devices because of their potential for failing suddenly and completely without warning rather than slowly and obviously as do currently approved devices.

In addition, they are "active" mechanisms rather than the present "passive" articles requiring no manipulation. The question that arises, therefore, is "will more people be saved from drowning because more will wear light, comfortable, attractive inflatables or will more people drown because the devices don't inflate or stay inflated or the victim cannot activate the device?" To investigate this and other related questions, the Coast Guard's Office of Boating, Public, and Consumer Affairs, through the Survival Systems Branch of the Office of Merchant Marine Safety, has been studying inflatables, their wearability, reliability, durability, ease of functioning, and consumer acceptance. This report is a description of an in-use study which was conceived utilizing volunteers from the Coast Guard Auxiliary.

In conjunction with preparation for the in-use study, an Advanced Notice of Proposed Rulemaking (ANPRM) was published in the Federal Register on 15 March 1979. In it, a number of questions concerning what were considered to be the major issues involved in approving inflatable PFDs were put to the general public.

At about this same time the distribution to Auxiliarist volunteers of approximately 550 inflatable PFDs of various configurations and means of inflation was being undertaken. The brands and models used as test samples were chosen to provide the widest diversity of styles available on the market at that time. Criteria used in the selection included fabric used, design, physical performance and wearability. Pictures and description of these test inflatables are in Appendix A. Auxiliarists were chosen as users since the Coast Guard assumed the risk involved if something were to go wrong and also, had more control over them in conducting the study. Fifty Auxiliary

volunteers were chosen from each district to participate. The devices were systematically selected from the entire supply received by the Coast Guard and distributed to the Auxiliarists. The inflatables were distributed so that the same proportion of each brand/model were supplied to each district. From this point on, the reader should keep in mind that there are two separate and distinct samples from two different populations.

(1) A set of samples of inflatable PFD brands and models chosen to be representative of the entire population of inflatable PFDs.

(2) A sample of a group of Auxiliarists who were not randomly selected from the entire population of inflatable users.

There are several reasons why the selection of Auxiliarists to use in the study is an imperfect representation of the boating population as a whole. They are for the most part more safety conscious for two reasons. One, they are on the average twenty years older than the general boat operator, which often makes them more careful; and two, Auxiliarists must pass safe boating courses. Also, as previously mentioned, the Auxiliarists were not selected randomly to participate but were volunteers which probably made the study results even less representative of the boating public.

Realizing the above points it was still believed that this study would provide good data concerning the use of inflatable PFDs in the boating environment.

Along with the PFDs, each participating Auxiliarist received an initial questionnaire soliciting background information regarding the person's physical characteristics, opinions, type of boating activity, and PFDs normally used. Each Auxiliarist was asked to conduct a brief familiarization exercise and to report his findings and impressions (see Appendix B for initial questionnaire and exercise). The PFD was to be used as desired for the boating season.

A second questionnaire was distributed to the Auxiliarists about midway through the boating season (see Appendix C). This quarterly questionnaire was intended to uncover the study participants' opinions of their inflatable PFD(s) following a period of experience with them. As a control, the questionnaire asked Auxiliarists some of the same questions about their approved PFDs as it did about their inflatable test PFDs. Question numbers 1-13, part two of the questionnaire, employ this comparison. The control responses make up the composite of all respondents' opinions concerning the entire family of inherently buoyant PFD designs. At the close of the boating season, a final questionnaire was distributed that dealt with some of the specific issues that earlier questionnaires, public comment, and experience had suggested as being particularly important (see Appendix D). The study participants were asked to return their test PFD, along with the questionnaire so that the devices' durability could be evaluated. This evaluation was done by a visual, and in some cases physical, inspection as the PFDs were received in the mail. There was no follow-up on those who did not return their PFD or questionnaire. The results of this evaluation were as follows:

(1) Three units of model C showed streaking and blotching of the bladder cover which appears to be fungus or oil. When inflated, the CO_2 rapidly escaped through the membrane.

(2) A couple of the units of design J had obvious corrosion problems with their zippers.

(3) The cartridges for design M could not be removed in two cases.

(4) One unit of model N had a bent pin which caused the cylinder not to inflate.

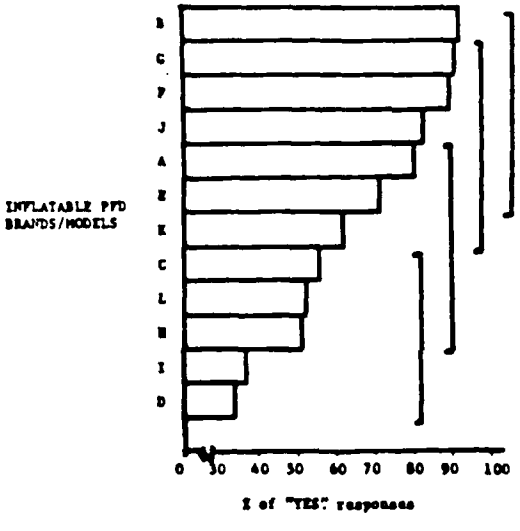
(5) A couple of units of design L had blown seams and were returned by the recipients without being used further in the study.

(6) Seventeen inflatable devices which the respondent stated had leakage problems after 24 hours were inflated by their inflation medium. Only one device held all of its inflation medium after 24 hours.

By the beginning of 1980 we received over 200 quarterly questionnaires and over 270 final questionnaires. The initial questionnaires were not analyzed. The numerical data from the quarterly and final questionnaires were tallied on computer. In order to find statistically significant differences between PFD brand responses when ranked from most to least favorable mean response, a "t" test was applied to the data. The results of these comparisons for both the quarterly and final questionnaires appear in bar chart format with "no significant difference" lines placed to the right of the bars. The method of interpreting the chart is described after the example bar charts which follow.

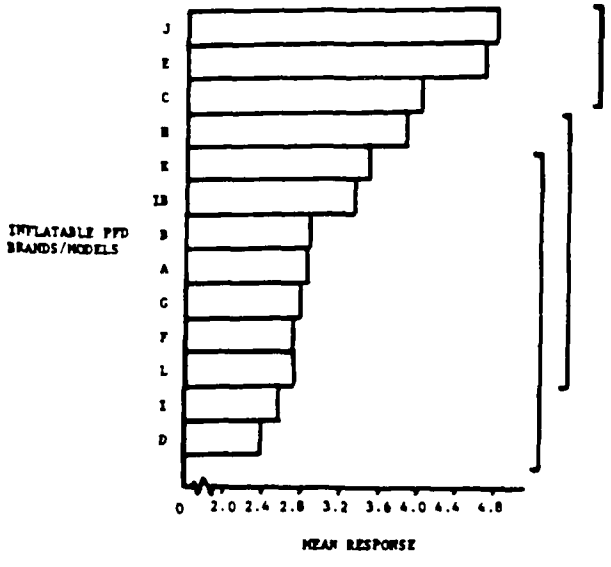
Two kinds of questions were asked in this study. One type is a question allowing just one of two possible responses, usually "yes" or "no". Example 1 is drawn from this type of question. The bar chart ranks the PFD brands by the percentage of the first response to the total number of responses for each question for each PFD. (Question 1.a. in the final questionnaire and question 4. in the quarterly questionnaire use the second response for ranking purposes.)

EXAMPLE ONE



2. Was the PFD still firm after 24 hours?
YES___ NO___

EXAMPLE TWO



11. If I owned this PFD, I would wear it more than I do the best of my current PFDs.

The second type is a question, Example 2, requiring one choice from five or six possible responses. In order to find the mean response for each PFD per question, each possible choice was assigned a number in sequence. The six possible response questions in the quarterly questionnaire were all assigned the following numbers:

Assigned Values		Possible Responses
1	-	Disagree Strongly
2	-	Disagree Moderately
3	-	Disagree Slightly
4	-	Agree Slightly
5	-	Agree Moderately
6	-	Agree Strongly

Questions 5, 6, and 14 in the quarterly questionnaire are in reverse order. The five possible response number assignments are shown beneath the appropriate graph.

The numbers were assigned to the response in such a way that the most favorable response receives the most value. The most favorable responses indicate the PFD in question has the maximum lifesaving potential, therefore, for both types of questions, the PFD brands at the top received more favorable responses then those at the middle or bottom of the chart. Since the collective responses by PFD brand differed in the sample of inflatable PFDs used for this study, a "t" test was required to determine if there was a significant difference in the responses between these PFDs brands. The lines beside the bars indicate that all PFD brands enclosed to the left of the line are not significantly different from each other. The reader can be 90% confident of these groupings because the "t" test was run at a 90% confidence level. There cannot be 100% confidence since in order to do that there would have to be an evaluation of every PFD with these brand names in use along with every user of these devices, which is obviously impossible.

No attempt should be made to group the PFDs into various levels of performance by numbering each "no significant difference" lines consecutively and concluding that the PFD brands enclosed by that line receive significantly more favorable response than the line groups beneath it. This group procedure can only be done when a particular line is free of overlap such as the top line in example two. In this example PFD brands J, E, and C received significantly more favorable responses as a group than the rest of the brands. On the other hand, the brands encompassed by the middle line cannot be separated from the bottom line in terms of groups, because of the large overlap of lines. What one can say about brands H through D is that H receives significantly more favorable response to this question than I and D in the total population of users of these particular brands.

The PFD brands are encoded for proprietary reasons. Each PFD manufacturer was assigned a code letter. The letters "IB" which appear among the brand codes on the six response choice quarterly questions stands for the composite "Inherently Buoyant" device. As previously stated, respondents were asked the same questions about inherently buoyant devices as inflatable PFDs in order to make comparisons between the two. The participants whose responses make up this component device are basing them on their own inherently buoyant PFDs. From our estimate of the comments received in this study, approximately 60% own Type IIIs, 30% have Type IIs and 10% own Type Is. Of the inflatables used in this study, 40% were similar when inflated to Type Is, 25% to Type IIs, 25% to Type IIIs and the remainder do not fall into any classification. The word "similar" is used since only the inflatables' physical effectiveness (i.e. donning, turning moment, buoyancy, etc.) is being judged for this type classification. This fact should be kept in mind when comparing individual brands/models to the composite inherently buoyant device. Type I inflatables (or II or III) are being compared to a combination

of inherently buoyant types. In some cases inflatables were compared with the respondents' Type I or II inherently buoyant devices which are less wearable that the Type III inherently buoyant PFD. This means that some inflatables were not compared to the most wearable inherently buoyant PFDs.

Written comments were compiled from the questionnaires according to question and PFD brand. The number in the parentheses to the right of each comment designates the frequency of occurence within the group of questionnaires for a particular brand. When "none" or "no event" or "no feature" appears it means that the respondent actually stated words to this effect in answering a particular question. When the answer space was left blank, it was not recorded since there is no way of knowing if the respondent forgot to answe: the question. Also, each brand is grouped under the style of device. The styles are:

1. - Yoke (Bib)

2. - Vest

3. - Belt

4. - Jacket

Brands F and N are placed under the yoke category because when inflated, they are yokes. They could just as easly be placed in the belt category since before inflation, they are of a belt design.

The group entitled "Automatic Inflators" is a particular brand of automatic inflators placed on several of the units of a couple of PFD brands used in this study. The comments presented relate only to the automatic inflator on the unit, not to other characteristics about the device. Other brands in this study also have automatic inflators but they are unique to that particular brand and therefore are covered in the written comments.

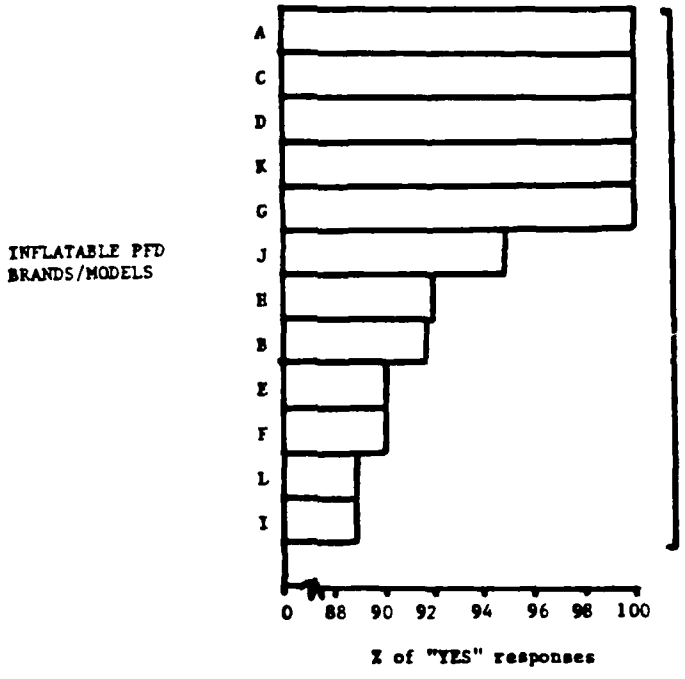
In the numerical analysis of the quarterly questionnaire and to a lesser

extent in the final questionnaire, some brands or models distributed to the Auxiliary are not included. This is because not enough questionnaires were received to make statistically valid comparisons. In order to provide some feedback to all manufacturers, written comments from the final questionnaire are included for all brands and models regardless of questionnaires received. See Appendix E for tally of questionnaires analyzed for each PFD.

In the Analysis and Conclusion section of this study, there is a reference to comparing a particular brand or model to the mean response for the entire group of inflatable PFDs. A separate, slightly different "t" test was used. In some cases, the results when comparing one brand to another for significant difference (the previous "t" test) against the overall mean are at slight odds with this "t" test. The reason for this is that one test is affected by two sample sizes, while the other is only affected by one. When these two "t" tests do not show the exact same results, it does not mean that either are wrong - it does give the reader additional information to use for analysis. The "t" test against the overall mean is also at the 90% confidence level.

Finally, for a major question on wearability (F4), a third "t" test was employed to compare an inflatable brand to an expected mean. This test is also affected by only one sample size and is at the 90% confidence level.

See Appendix G for details on the four statistical tests used in this study.



1. Did the PFD inflate and perform properly? YES____ NO____

1) If the PFD did not inflate and perform properly, what was the cause if you could determine it?

I YOKES

1. (H)
   - Leak at oral inflation valve (1)
   - Valve was not properly reset when new cylinder put in. Pulling string would not release CO2 (1)
   - The valve pin did not fully puncture cartridge (1)

2. (B)
   - CO2 cocking device did not reset to fire (1)
   - Over inflation (1)

3. (E)
   - Poor performance of metal zipper (1)
   - Slow leak (1)
   - Hole at bend of oral inflation tube (1)
   - Partial inflation due to incomplete puncture of CO2 cylinder when handle pulled slowly (1)

4. (F)
   - Over inflation possibly making fittings too tight (1)

5. (A)
   - Must be topped off by mouth (2)

6. (C)
   - None (1)

7. (G)
   - Neck opening too small making it difficult to don and impossible to remove when inflated (1)
   - Leak at valve (1)

8. (D)
   - None

II VESTS

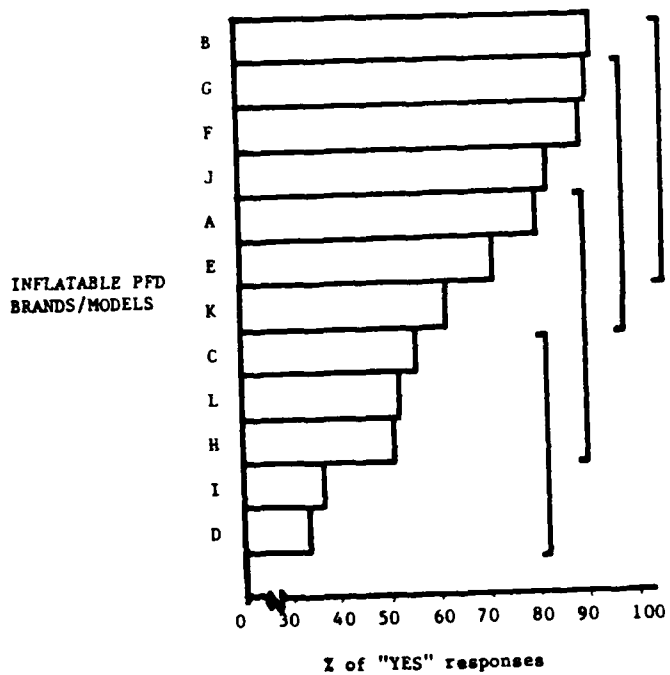
1. (I)
   - Mechanism was not properly set (1)
   - Cylinder had to be pulled hard to cause inflation (1)
   - Velcro held closed in neck area possibly due to incorrect folding (1)
   - CO2 cylinder installed in manner so that release valve did not work (1)
   - Cylinder did not fully inflate bladder (1)

III BELTS

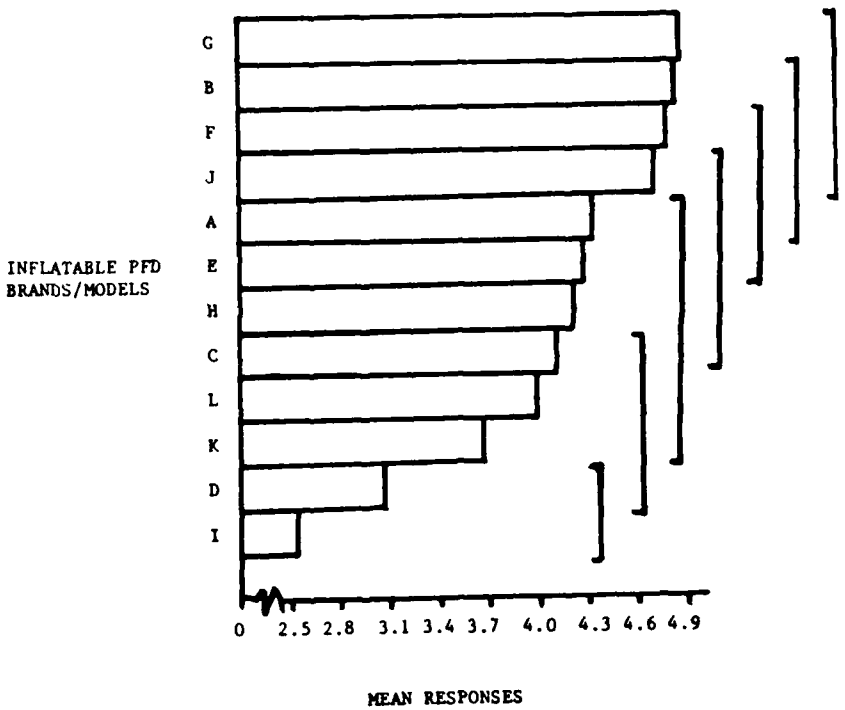
1. (L)
   - Does not provide proper head support (1)
   - Loses air quickly (1)
   - Seam blew out with inflation of the PFD for the second time (1)

2. (K)
   - Had to jump in water and help squeeze handle since individual could not operate it even after practicing (1)

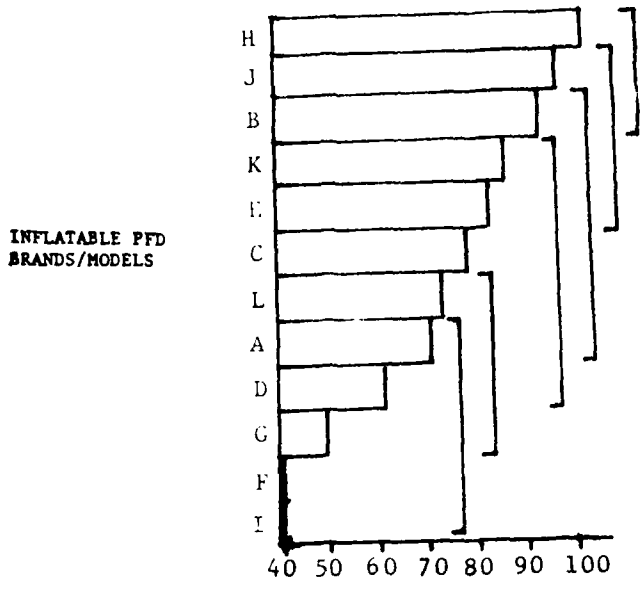
IV Automatic Inflator (P)
- Chemical inflation elements became wet (1)
- Forgot to change red button, therefore did not inflate automatically. Did inflate with lanyard. Replaced red button and CO2 cylinder then it did inflate (1)



2. Was the PFD still firm after 24 hours?
YES___ NO___



3. After 24 hours, what fraction of the chamber was still inflated? 5-Full 4-3/4 full 3-1/2 full 2-1/4 full 1-Flat



4. Did you encounter problems restoring the PFD to a serviceable condition? YES___ NO___

4) If you did encounter problems restoring the PFD to serviceable condition, what were they?

I YOKES

1. (F)
   - Hard to repack into cover (5)
   - No instructions (2)
   - Difficult zipper to reclose (2)
   - Zipper tab easy to lose (2)

2. (G)
   - Hard to repack into cover (5)

3. (I)
   - Cover too small for bladder (3)
   - Had to clean valves of corrosion (1)
   - Too difficult and time consuming (1)
   - Inflation caused choking (1)

4. (A)
   - Hard to remove and insert new CO2 cylinder (Plug was difficult to unscrew to replace cartridge) (1)

5. (C)
   - Snaps hard to fasten (1)
   - Difficult to repack (1)

6. (E)
   - Failed to set trigger mechanism when CO2 cylinder was replaced (2)
   - Did not know what type of glue to use to repair leak (2)

7. (B)
   - Difficult to deflate through oral inflator. Must use prong (1)

8. (H)
   - Deflation too easy. It could happen accidently. Mouth piece pulls up too easily (1)
   - PFD leaks around CO2 cylinder but stays full when orally inflated

II VESTS

1. (I)
   - Difficult repacking (ie. deflation, closing outside cover, etc.) (8)
   - No safety devices for trigger mechanism (1)
   - If the cylinders are not seated or if the bladders are damaged, PFD will not perform. Need to be expert to repack (vacuum needed) (1)
   - Hard to repack without instructions (1)
   - Need correct size of CO2 cylinder (1)

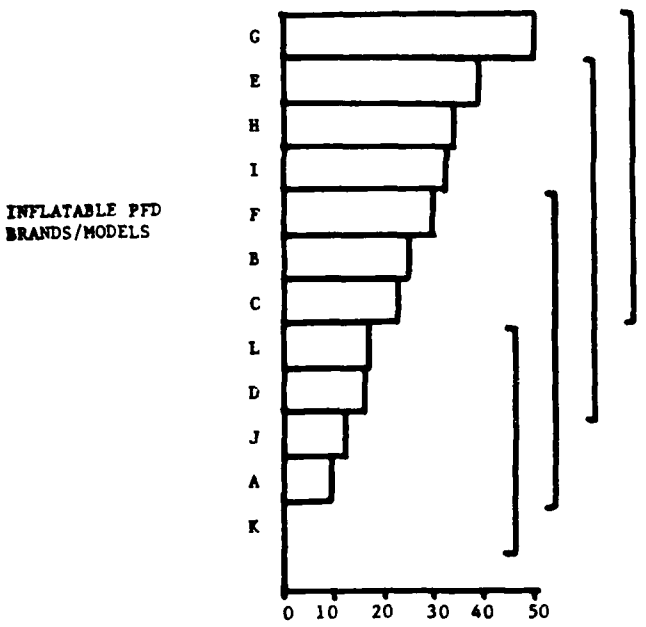
2. (J)
   - Zipper needed to be lubricated with silicone (1)
   - No safety device for trigger mechanism (1)

III BELTS

1. (L)
   - Difficult to repack (3)
   - Poor directions, need graphic instructions (3)
   - Changing CO2 cylinder requires pliers (2)
   - Plunger (O-ring) stuck (1)
   - Need to sell CO2 cylinders (1)

2. (K)
   - Hard to repack (3)
   - Takes 5 minutes to install new CO2 cylinder (1)

IV Automatic Inflator (P)
   - Remembering to replace red button (1)



5. Do you think the Coast Guard should require a qualified service facility to restore the device to a serviceable condition? YES___ NO___

5. Comments concerning whether the CG should require a service facility to restore PFD to serviceable condition.

I YOKES

1. (H)
   - Boaters would not bother to service (2)
   - User caused defects should be charged to user (1)
   - Simple to reset release valve but it may be forgotten (1)
   - If vest can be repaired at reasonable cost (1)

2. (A)
   - If cylinder and mechanism needs replacing, average boater won't do it (1)
   - Doubt service would be used (1)
   - Service kit should be provided and a usable shelf date should appear (1)
   - Depends on defect (ie. seam leaks, yes; pin holes, no) (1)

3. (E)
   - Cost of vest is high enough to have replacement parts available (1)
   - Only a qualified person should do repairs or service (1)
   - Should have well written instructions (1)
   - Should have no difficulty reusing vest (1)
   - Unless required by law most people will not service it (1)
   - Relatively easy to install new cartridge without instructions (1)
   - Have simple repair but for all use (1)
   - Detailed instructions with graphics printed on PFD on how to service PFD is sufficient (1)

4. (B)
   - Only if there is a puncture in bladder (1)
   - Cost of device will require a repair center (1)

5. (C)
   - Boater can do servicing (1)
   - Practice eliminates problems (1)
   - Visual and owner pressure check is sufficient (1)

6. (F)
   - This type of service is not applicable here (1)
   - Removable zipper could cause repacking problems (1)
   - Cost of service important, boater could do it but it is difficult (1)
   - Initial inflation damages zippers (1)
   - Boater can temporarily patch hole in emergency (1)

7. (G)
   - PFD is expensive, spare parts should be available. Some joints may be heat bonded and irrepairable by owner (1)

8. (D)
   - Don't think service would be used (2)
   - An unworkable concept (1)
   - We don't need added expense to increase our taxes (1)
   - User should be able to perform service (1)
   - Patches should be available as well as inexpensive cylinders (1)

II VESTS

1. (I)
   - Bladder should not be repaired; should be self-sealing (1)
   - Should be restored by individual (1)
   - Simple instructions on care and restoring after use should suffice (1)
   - Need instructions for self-servicing (1)
   - It probably would not be taken to service facility due to inconvenience (1)

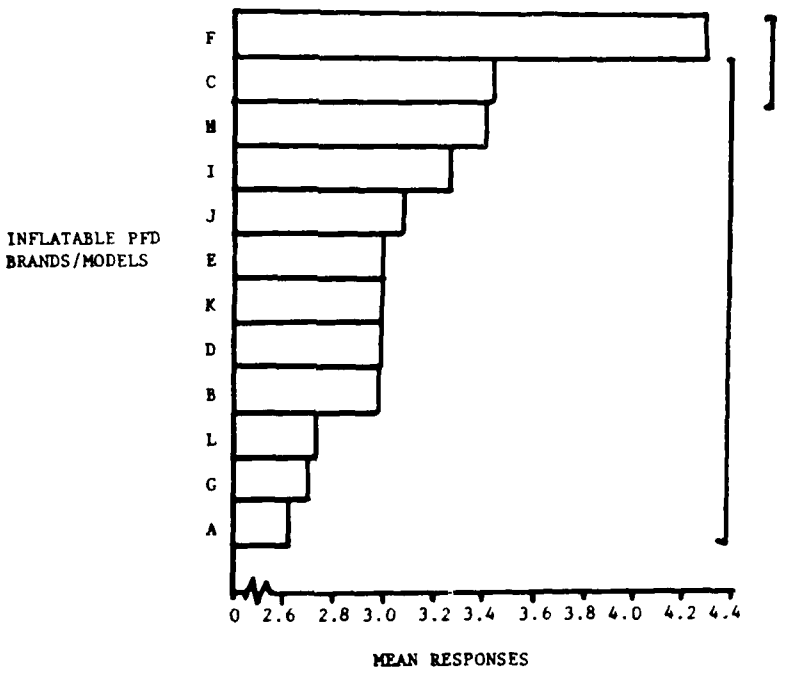
2. (J)
   - Boater should make checks (2)
   - Coast Guard shouldn't be involved in maintaining lifesaving equipment (1)
   - Easy to restore to serviceable condition (1)
   - Easy to install CO_2 cylinder and reset trigger device (1)
   - Most owners would not return PFD for maintenance (1)
   - Replacement parts should be made available (1)
   - Could be costly (1)
   - Most people would service their own; would be willing to pay to have it done correctly (1)

III BELTS

1. (K)
   - Boater could service, if not serviceable, discard (2)
   - Not practical (1)
   - The only part needing service would be trigger mechanism (1)
   - Instructions should be placed on unit (1)
   - Should not be considered a PFD unless in serviceable condition (1)

2. (L)
   - Not difficult for owner (1)
   - Instructions are satisfactory (1)
   - Not needed if diagram instructions are available (1)
   - Should be discarded if not immediately serviceable (1)

IV *Automatic Inflator* (P)
   - Many civilians would not have proper experience (1)



6.a. How often do you think a boater or qualified service facility should check the inflatable PFD?

5-Annually 4-Semi-Annually 3-Quarterly 2-Monthly 1-Other

6a) Comments concerning how often a boater or qualified service facility should check the inflatable PFD.

I YOKES

1. (H)
   - Annually or after use (1)
   - Usually every month, inflate once a year (1)
   - Monthly if not used (1)

2. (A)
   - Before wearing (2)
   - Orally inflate or deflate before each cruise (1)
   - Visual check before wearing (1)

3. (E)
   - Boater should check monthly (1)
   - Qualified service center should check every other year (1)
   - Upon entering boat (1)
   - After each use (1)
   - Before sailing (1)
   - If PFD used in salt water, check quarterly (1)

4. (B)
   - Daily while boating (1)

5. (C)
   - Before use (1)

6. (F)
   - Once a year (1)
   - Spring and summer (1)

7. (G)
   - Before each cruise (1)
   - After use (1)

8. (D)
   - Before each cruise (2)
   - Boater should check daily or weekly (1)

II VESTS

1. (I)
   - 5 years, if not used (1)
   - Visual quarterly, pressure test annually (1)

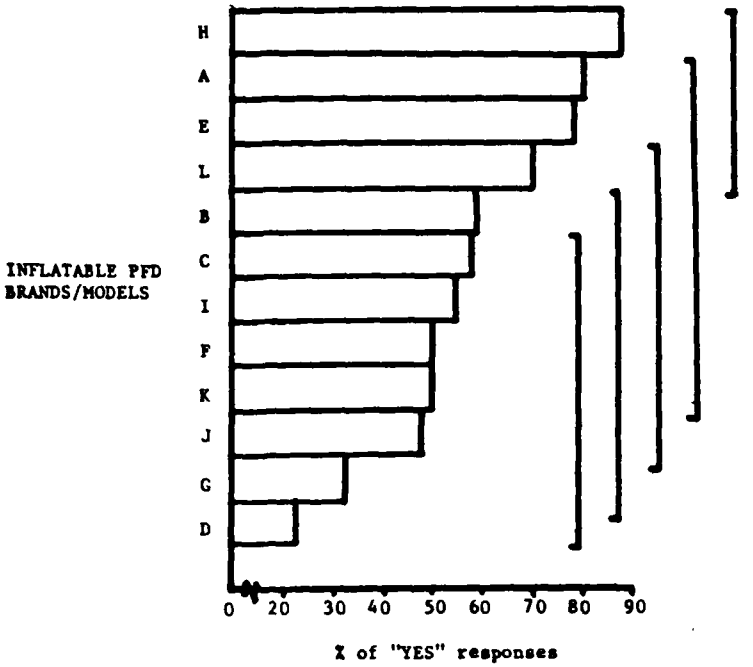
2. (J)
   - Weekly (2)
   - After each CO2 inflation (2)
   - Every time before wearing (2)
   - Each time boater goes out (2)

III BELTS

1. (L)
   - Each time vessel goes out (1)
   - Depends on care and placement of storage (1)

2. (K)
   - Before each outing (1)
   - 3 months (1)

IV Automatic Inflator (P)
   - At the beginning and the middle of the boating season - April or May and July or August (1)



6.b. Would you do any checks in between the required checks you recommend in (a)? YES___ NO___

6b) What additional checks between required checks would you recommend?

I YOKES

1. (H)
   - Orally inflate, check for leaks (4)
   - Check once a week during usage (3)
   - Visually check everytime boat goes out (3)
   - Check for clean dry storage (2)
   - Check for cocked inflation mechanism (2)
   - Visual on CO_2 cartridge (2)
   - Orally inflate every six months (1)

2. (A)
   - Check straps and fabric for tears or wear (2)
   - Monthly (1)
   - Check before boating season (1)
   - Before wearing (1)

3. (E)
   - Orally inflate and check for leaks (7)
   - Check after each use using checklist (1)
   - Orally inflate and leave overnight (1)
   - Visually check for cuts, tears, rotted stitch (1)

4. (B)
   - Orally inflate before each use (2)
   - Check for cracking in bladder and firing device (1)
   - Check strap and mouth inflation tube semiannually (1)
   - Check CO2 cartridge (1)

5. (C)
   - Visual check (3)
   - Orally inflate (2)
   - Check cartridge for corrosion and whistle and oral inflation (1)

6. (F)
   - Check each time worn to see that pull cord is clear and zipper is in place (1)
   - Visual inspection (1)
   - Orally inflate (or with air pump) (1)
   - Should withstand normal use (1)
   - Check for puncture and tears (1)
   - Additional checks not reasonable because repacking is difficult (1)

7. (G)
   - Visual (1)

8. (D)
   - Check for leaks and corrosion on valves (1)
   - Fastenings check (1)

II VESTS

1. (I)
   - Visual check (3)
   - Fullness of cylinders (2)
   - Check for leaks (1)
   - Visual check before each voyage (1)
   - Examine CO2 mechanism (1)

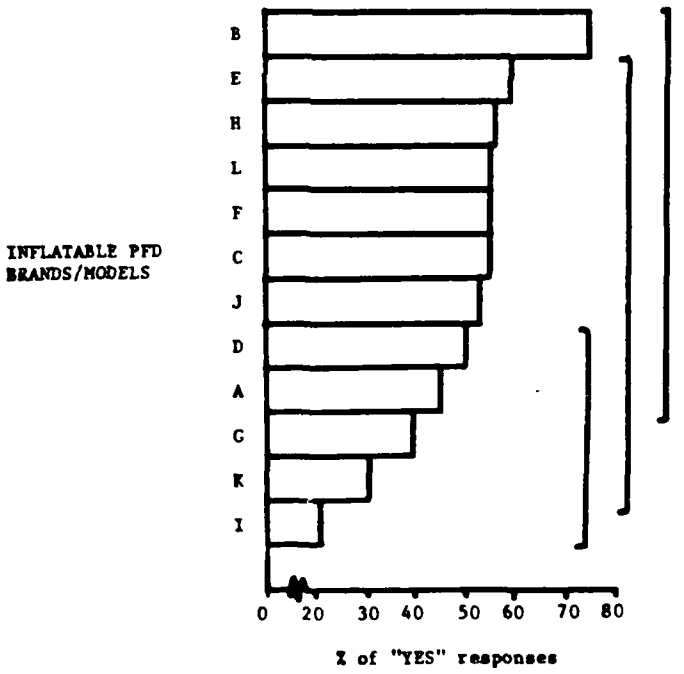
2. (J)
   - Visually check straps, zipper, CO2 cartridge (4)
   - Orally inflate before each use (2)
   - Visually check everytime before use (2)
   - Submerge in water to check for leaks (1)
   - Lubricate and check zipper monthly (1)
   - Check for tears in pockets (1)
   - Check bladder periodically (1)
   - Check new CO2 cartridge and position of inflation lever, check inflation by oral inflation method (1)
   - Keep half inflated at all times and press down on bladder prior to getting underway (1)
   - Visual check after each use (1)

III BELTS

1. (L)
   - Check before each voyage (3)
   - Orally inflate before each use (2)
   - Visual check for tears, weak spots, etc. (1)
   - Make sure belt is in good shape and fitted to individual size (1)
   - Familiarize with donning and repacking procedure (1)

2. (K)
   - Visual examination (2)
   - Visual examination prior to each voyage (1)
   - Orally inflate once a week (1)
   - Orally inflate once a month (1)

IV Automatic Inflator (P)
   - Personally look over PFD monthly (1)



6.c. Would you expect the average boater to perform these checks? YES___ NO___

7) How would you determine if this PFD was serviceable prior to getting underway?

I YOKES

1. (D)
   - Orally inflate, check for leaks, check straps and fasteners for signs of wear or rot (3)
   - No way that is not time consuming (2)
   - Check for cylinder properly in place and manual inflation valve is closed (2)
   - Check for mildew and rust on valve (1)
   - Visual for punctures (1)

2. (F)
   - Orally inflate and check for leaks (3)
   - Visual inspection (2)
   - Visual inspections, check firing lever, check cylinder for tightness, oral inflator and make sure cover is in place (1)
   - Inflate with pump, check for rust (1)
   - People wouldn't check-takes too much time (1)
   - Check CO2 cartridge and oral inflator (1)

3. (C)
   - Inflate orally (5)
   - Check for tears, worn spots and CO2 cartridge (2)
   - Visually check then inflate (1)

4. (G)
   - Orally inflate (4)
   - Visual inspection (2)
   - Visual inspection then inflate (1)
   - Too much hassle (1)
   - Check CO2 cylinder (1)
   - Check to see if firing pin moves freely (1)

5. (H)
   - Orally inflate, visual check (8)
   - Check for new CO2 cylinder and visual check of general condition (2)
   - Orally inflate amd listen for leaks. Put fill end of oral inflator in water to check for leaks. This is where device leaked (2)
   - Check to see if CO2 cartridge is full and trigger mechanism is cocked (2)
   - Visual inspection and if concerned inflate, CME should have owner inflate jacket as a check (1)
   - Inflate overnight before voyage, check cylinders and harness (1)

6. (B)
   - Orally inflate (4)
   - Visually inspect (3)
   - Check CO2 cartridge (2)
   - Average person would find it difficult (1)
   - Inflate and hold underwater (1)
   - Inflate and listen for leaks (1)

7. (E)
   - Orally inflate (4)
   - Visual check for cracks, rips, etc. (2)
   - Visual check of cartridge and bladder monthly (1)
   - Would have to be examined each time-it probably wouldn't be done (1)
   - Orally inflate, hold for 15 minutes to detect leak everytime boat is used (1)
   - Inspect for tears; short test by oral inflation tube, check cartridge insertion and examine trigger to be certain it is set. Waist band should be loose and tested for fit (1)

8. (A)
   - Orally inflate and check for leaks and CO2 cartridge (3)
   - Not possible without inflating (1)
   - Visual inspection (1)
   - Orally inflate and place in water (1)
   - Must test each time (1)

II VESTS

1. (J)
   - Orally inflate and check for leaks (12)
   - Check new cylinder and position of inflation lever, orally inflate (5)
   - Visual check is sufficient for tears, rips and punctures (4)
   - Check CO2 and oral inflation device (3)
   - Submerge in water and test for leaks, probably wouldn't be done (2)
   - Visual inspection. If PFD is old, orally inflate (1)
   - Check fasteners; inflate orally and observe after 24 hours (1)
   - Very serviceable, needs only periodic check of CO2. Hard to get CO2 and very expensive (1)

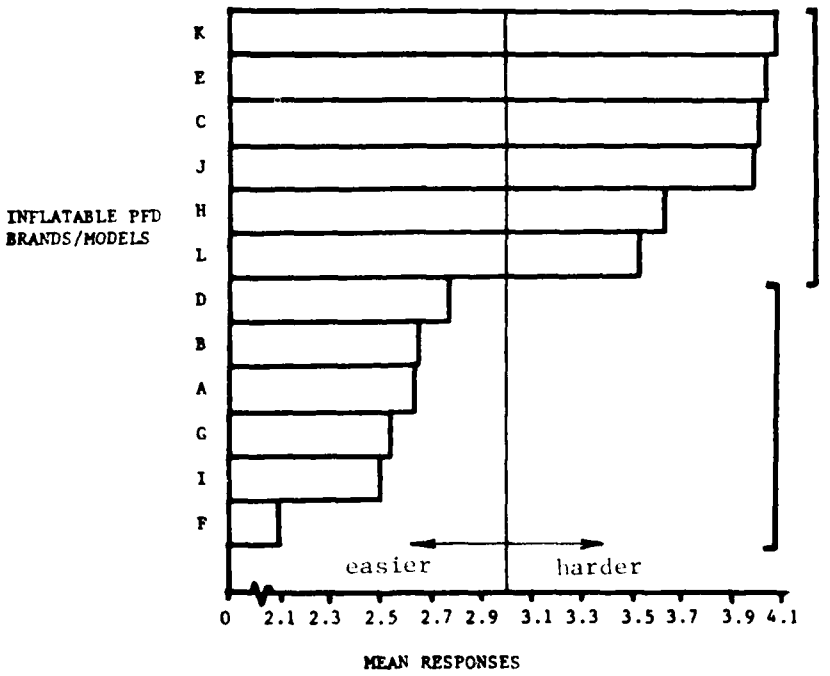
2. (I)
   - Visual examination (punctures, tears, etc.) (2)
   - Visual check should be adequate. Unwrapping and orally inflating and rewrapping is not practical (2)
   - Check CO2 and oral inflator (1)
   - Check flatness (1)
   - Check tears (1)
   - Inflate PFD, allow ample time to see if PFD remains inflated (1)
   - Unable, cannot check (1)
   - Orally inflate and do pressure test before leaving dock (1)
   - Require a seal similar to parachutes on the tubes and/or cover (this model has a cover over the bladder). Otherwise a full CO2 cylinder can only be assumed if the tabs aren't too far out and the cover is closed, which does not guarantee that cylinders are full or that it hasn't been functioning or stuffed back in without new cylinders (1)

III BELTS

1. (K)
   - Could not (2)
   - Orally inflate (2)
   - Visual inspection (2)
   - Visual each time, inflate quarterly and replace cartridge (1)

2. (L)
   - Orally inflate, check for leaks and full CO2 cylinder (7)
   - Visual check (3)
   - Inflate in water (3)
   - No way to be deflated (2)
   - Should periodically test manual inflating device (1)
   - Check trigger and CO2 cartridge (1)

IV Automatic Inflator (P)
   - Inspection (2)
   - Visual inspection and oral inflation (1)
   - Check for tears, deterioration, etc., make sure cylinder was not discharged. I don't know how to check auto inflation element to ascertain whether it had absorbed moisture making it inoperative (1)
   - Check red button position to see if CO2 cylinder has been discharged (1)



8. How would you compare the ease of donning this PFD with your CG approved PFD? 5-Much easier to don 4-Easier to don 3-About the same 2-Harder to don 1-Much more difficult to don

9) How would you compare the wearability of this PFD (deflated) with your Coast Guard approved PFD?

a. The inflatable is: 1 - more bulky
2 - same
3 - less bulky

The mean response for all inflatable PFD brands was 2.69 with a standard deviation of .27. Standard deviation means that in repeated tests 68% of the sample means would fall between 2.96 and 2.42 ($\bar{x} \pm .27$).

b. The inflatable is: 3 - more comfortable
2 - same
1 - less comfortable

The mean response for all inflatable PFD brands was 2.48 with a standard deviation of .38.

c. The inflatable is: 3 - more attractive
2 - same
1 - less attractive

The mean response for all inflatable PFD samples was 2.27 with a standard deviation of .34.

10) Compare the in water performance of the inflatable with your CG approved PFD.

I YOKES

1. (C)
   - Easily drained, adjusts to size, no sign of wear, nobody realizes I'm wearing a PFD (1)
   - Fits tightly and tends to choke wearer when in water (1)
   - Less buoyancy (1)
   - Greater buoyancy - feels more secure (1)
   - Can be reinflated, whereas approved jacket either sinks or floats (1)

2. (G)
   - Irritating around the neck (1)
   - Not impressed with inflatables as a whole, it's hard to check operability without using a CO2 cartridge, afraid of inflatables (1)
   - More difficult to perform work in water (1)
   - "I wear the PFD on the belt, folded in its case about 5 times more frequently than I wear normal PFD" (1)
   - Coldness from expanding CO2 can cause "freeze cracking" in the fabric, so use oral inflation to test operability (1)

3. (H)
   - Probably has alittle more buoyancy than the standard Type II or III. Keeps the head well out of the water (3)
   - PFD rides up (when strap not adjusted) (2)
   - Better inert body rotation to face-up position (1)
   - Body strap too tight when inflated (1)
   - Neck support good (1)
   - Great performance, but uncomfortable for a woman to wear (1)
   - Inflating requires locating pull tab (1)
   - PFD can slip over head, unless one is a large person (1)
   - Turning moment is longer with inflatable, apprx. 10-12 sec. (1)

4. (D)
   - Partially blocked vision (2)
   - 3 ft. jump into water caused PFD to ride up around head placing nose and mouth underwater. In swimming position the straps rode up around rib cage causing enough pressure and pain to prevent swimming (2)
   - Holds head out of water (1)
   - More freedom of movement in water (1)
   - Device floats person straight up (1)
   - More suitable for child size (1)
   - PFD sustained my weight (1)

5. (F)
   - Holds wearer's head and face well out of the water (2)
   - Cover flips up and protects the face from water and sun (1)
   - Neck of PFD so tight that it is not easily donned by adults. People with glasses must remove them first. If PFD is donned wrong side forward before inflation it blows up right against waist straps and is impossible to relieve without deflating partially. End of zipper hard to keep track of (1)
   - More comfortable and easier to use if some pressure is released (1)
   - Feels bulky on chest (1)
   - Good flotation (1)

6. (B)
   - More difficult to move around in (1)
   - Rides up (1)

7. (E)
   - Good in rough water (1)
   - Worry about air leakage (1)
   - Unconsciousness problems (1)
   - PFD was used as "B.C." in scuba diving. Performed as well as other BC's (1)
   - Support is same (1)
   - C.G. PFD is more reliable (1)

8. (A)
   - Better head support than type I (1)
   - Inflate 3/4 full with CO_2 cylinder (1)
   - By adding more air orally, it is much improved over the regular one (1)
   - Warmer around neck area (1)

II VESTS

1. (I)
   - Not self-inflating (1)
   - May be worn more often because of comfort and freedom of action (1)
   - Unconscious problem with inflatable (1)
   - PFD very uncomfortable - less freedom of movement (1)
   - A piece of junk (1)
   - Belt type, hard for person to use and stay upright (1)
   - No noticeable difference in support or ability to maneuver (1)
   - The PFD had 2 bladders either of which was adequate while both were cumbersome and uncomfortable (1)
   - Too hard to pull to inflate (1)
   - With both chambers full it was impossible to remain face down and it kept the head high and tilted back. My regular PFD wouldn't turn me over. The head is more upright and lower in the water, more buoyancy (1)
   - Hurt wearers neck before inflation (6 people). In water there is too much around head and face (like being in tube) people would panic - visibility completely shut off (1)

2. (J)
   - More buoyant (4)
   - Great PFD overall - should be approved (3)
   - Better flotation - time to bring unconscious person above water is less (3)
   - Inflatable has better turning moment (2)
   - Worried about puncture (2)
   - Unconscious problem (2)
   - Should be tighter when inflated to prevent ride-up (1)
   - PFD must be fully inflated - difficult to accomplish in rough water (1)
   - Not self-righting (1)
   - Could maneuver in water and inflate when desired (1)
   - Pockets fill up with water and needs to be tighter under chin (1)
   - Becomes uncomfortable under arms (1)

III BELTS

1. (L)
   - Unconscious problem (2)
   - Liked whistle (1)
   - When worn on stomach will not keep person's face out of water (1)
   - Tends to turn wearer on side when still. If strapped on tight, very uncomfortable when inflated (1)
   - Not enough flotation, especially over a long period of time or in cold water (no hypothermic protection) (1)
   - No feeling of security - maybe useful with regular PFD (1)
   - Could be used for water sports or close to shore activities (1)
   - Not as steady in keeping head out of water and slightly tilted aft (1)
   - Will not turn a 200 lb. person over if unconscious. 150 lbs., it did (1)
   - Can be punctured by fishing hooks (1)
   - Has tendency to ride up with only one strap around midsection to hold it in place (1)

2. (K)
   - Inflatable not as good for disabled person (1)
   - Would not hold air longer than 3 hours (1)
   - The device is pretty but highly impractical as a PFD (1)
   - Does not lift the head out of the water when lying face down or on the back (1)
   - Impairs swimming more than present PFD (1)
   - Not secured to body, unconscious person might slip out (1)
   - More secure feeling in regular PFD (1)
   - It inflated quickly and was just as easy to swim with (1)

IV Automatic Inflator (P)
   - Inflatable has slightly more turning moment (1)

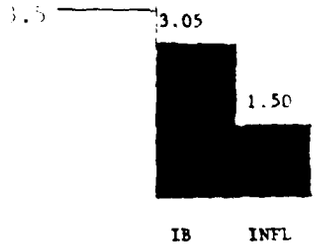
11) How would you compare the reliability of the inflatable with your Coast Guard approved PFD?

3 - more reliable
2 - same
1 - less reliable

The mean response for all inflatable PFD brands was 1.54 with a standard deviation of .16.

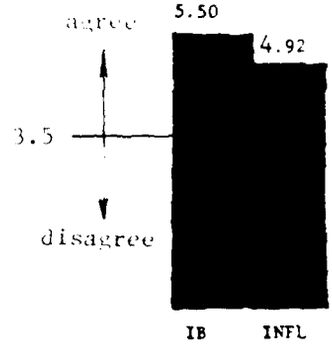
QUARTERLY QUESTIONNAIRE - PART TWO

SIGNIFICANT DIFFERENCE



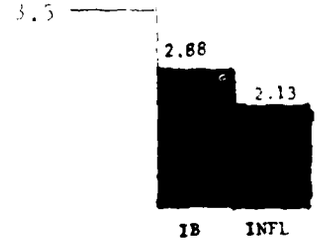
1. This PFD can be conveniently used as a cushion or pillow to sit or recline on.

SIGNIFICANT DIFFERENCE



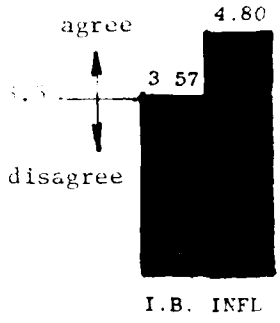
2. If I had this type of PFD aboard my boat, I would keep it out in the open so it would be accessible in case of an emergency.

SIGNIFICANT DIFFERENCE



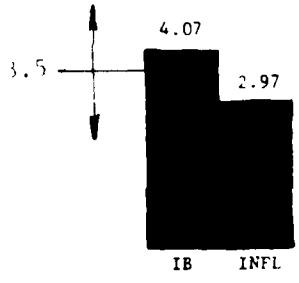
3. This PFD would help keep the wearer dry in rain or spray.

SIGNIFICANT DIFFERENCE



4. This PFD does not restrict my movement or get in my way.

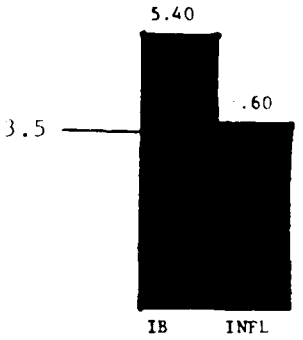
SIGNIFICANT DIFFERENCE



Reversed: 6 = Disagree Strongly
1 = Agree Strongly

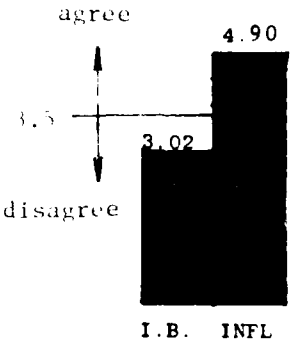
5. If not carefully maintained and checked, this PFD might deteriorate quickly to the point where it would malfunction.

SIGNIFICANT DIFFERENCE



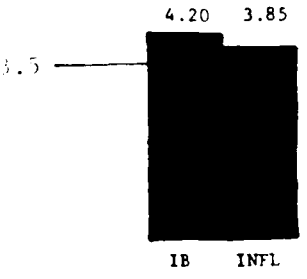
6. In a genuine boating emergency, I'd want to be wearing or using a PFD of this type.

SIGNIFICANT DIFFERENCE



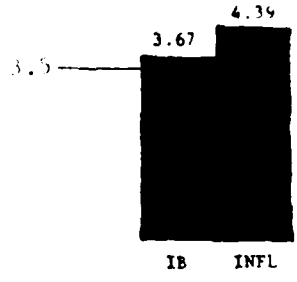
7. This PFD is not excessively hot or sweaty in warm weather.

SIGNIFICANT DIFFERENCE



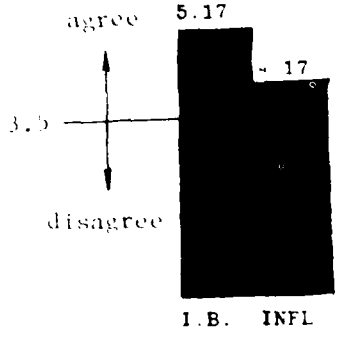
8. This PFD is useful for my boating activities in addition to providing flotation in the event of an accident.

SIGNIFICANT DIFFERENCE



9. This PFD does not detract from the appearance of the person who wears it.

SIGNIFICANT DIFFERENCE

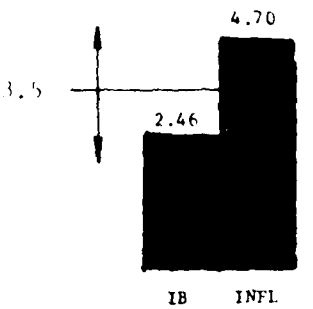


10. This PFD looks like it would work well even in rough water.

The "I.B." bar was eliminated since the wording of the question made this part of the data meaningless.

11. If I owned this PFD, I would wear it more than I do the best of my current PFDs.

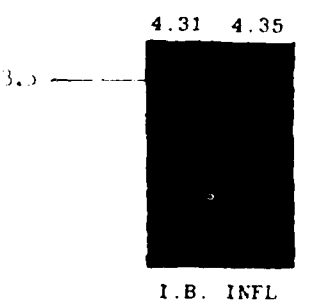
SIGNIFICANT DIFFERENCE



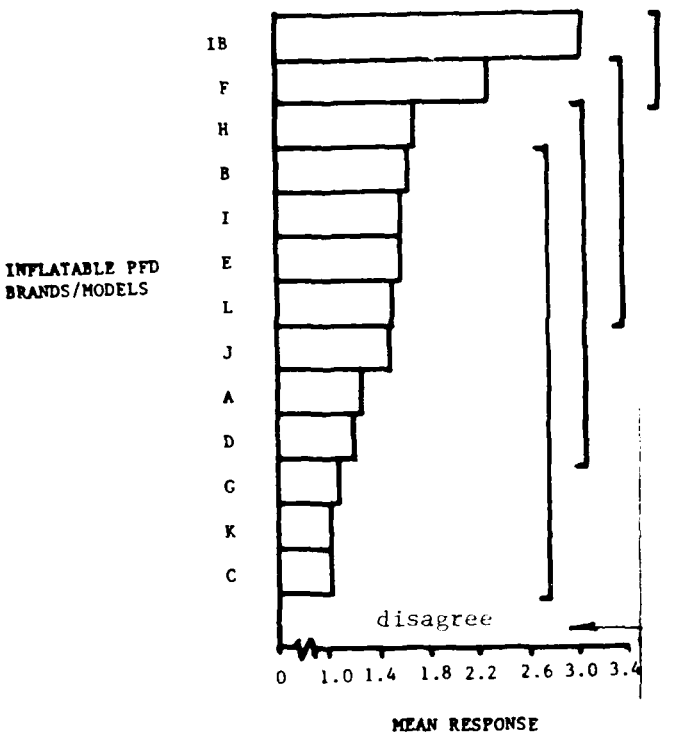
Reversed: 6 = Disagree Strongly
1 = Agree Strongly

12. This PFD feels bulky when worn.

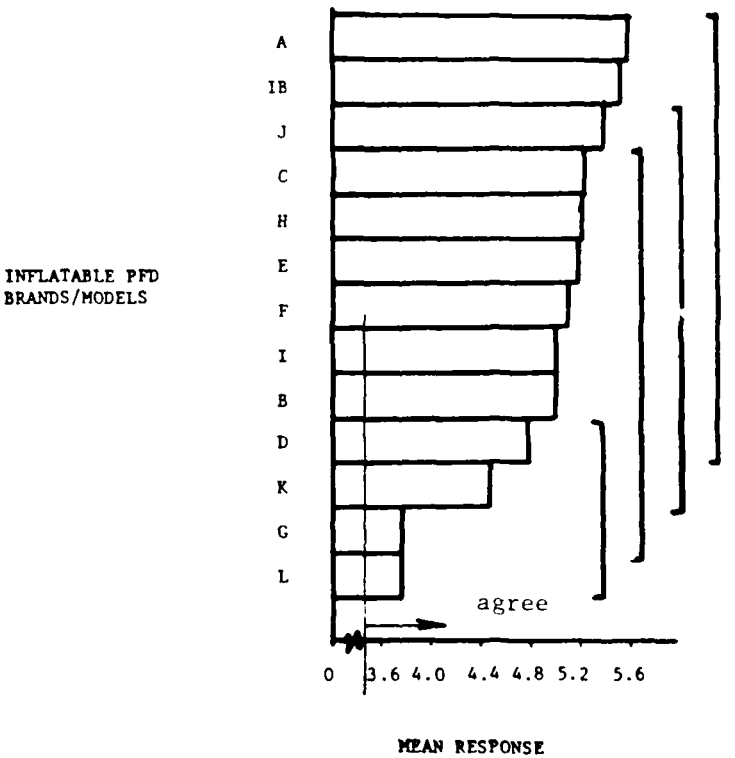
NO SIGNIFICANT DIFFERENCE



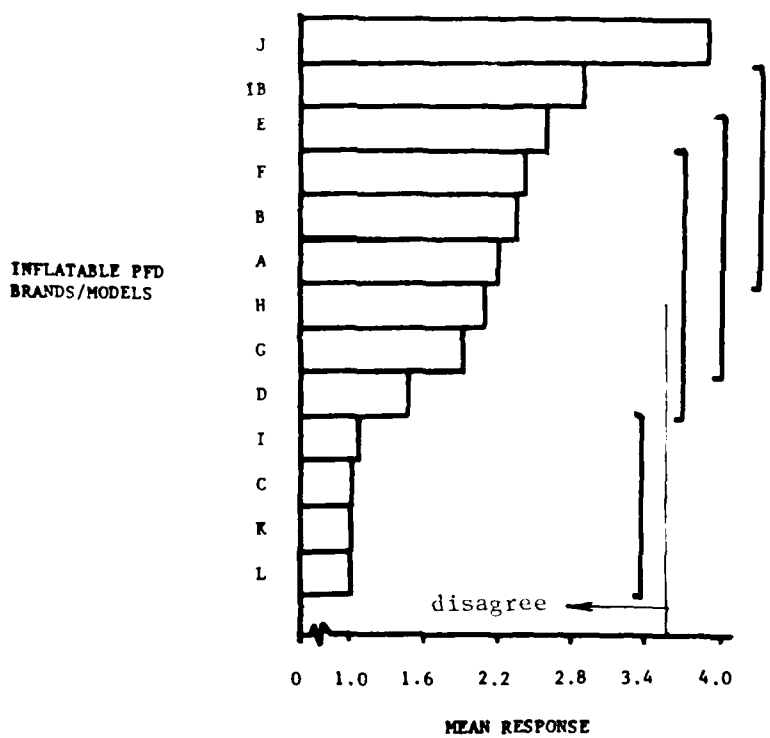
13. This PFD does not rub, scrape, or pinch the wearer's skin.



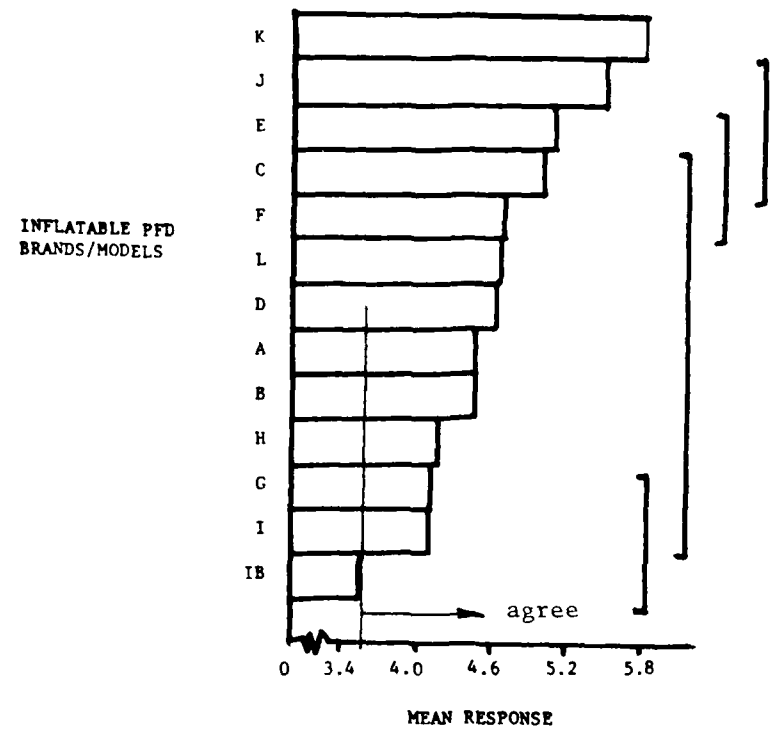
1. This PFD can be conveniently used as a cushion or pillow to sit or recline on.



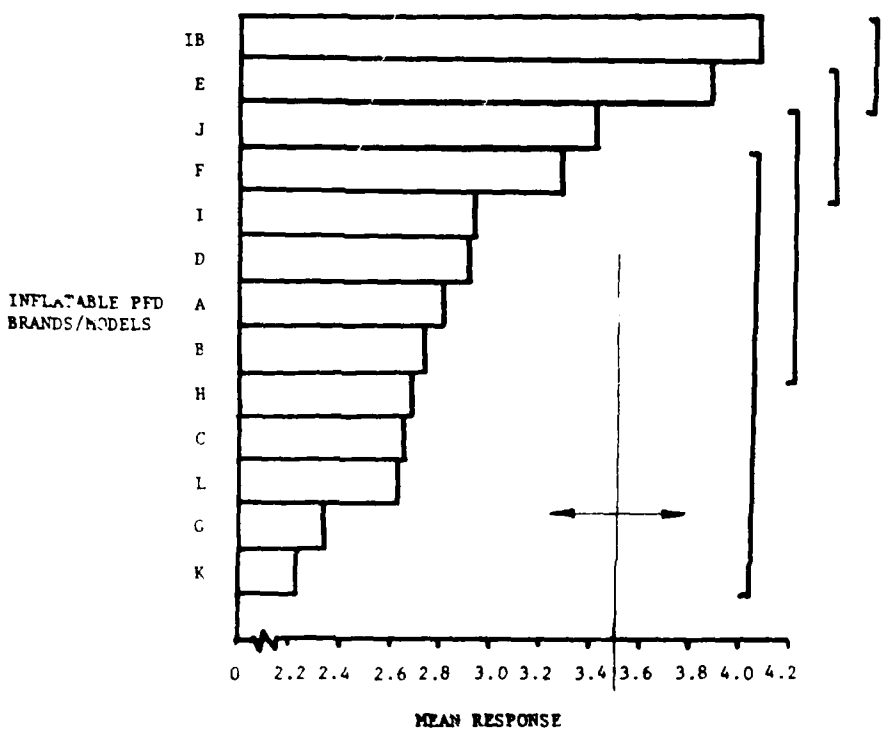
2. If I had this type of PFD aboard my boat, I would keep it out in the open so it would be accessible in case of an emergency.



3. This PFD would help keep the wearer dry in rain or spray.

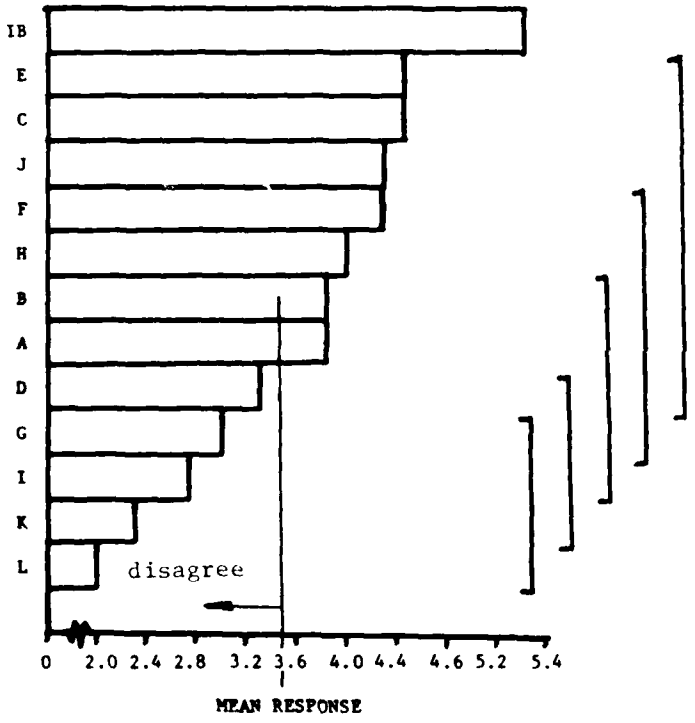


4. This PFD does not restrict my movement or get in my way.

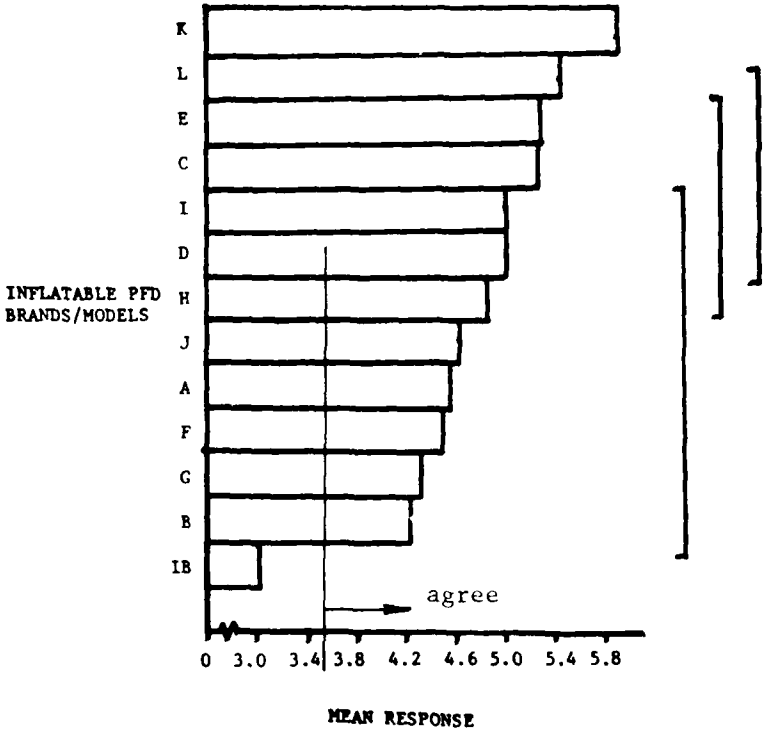


Reversed: 6 = Disagree Strongly
1 = Agree Strongly

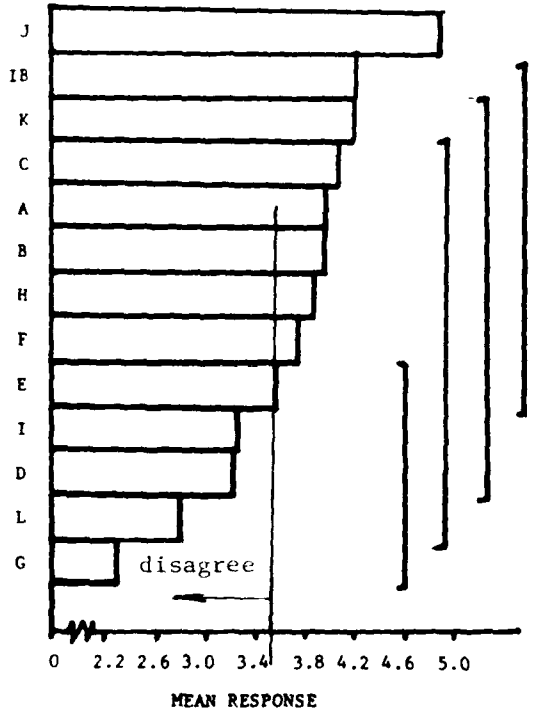
5. If not carefully maintained and checked, this PFD might deteriorate quickly to the point where it would malfunction.



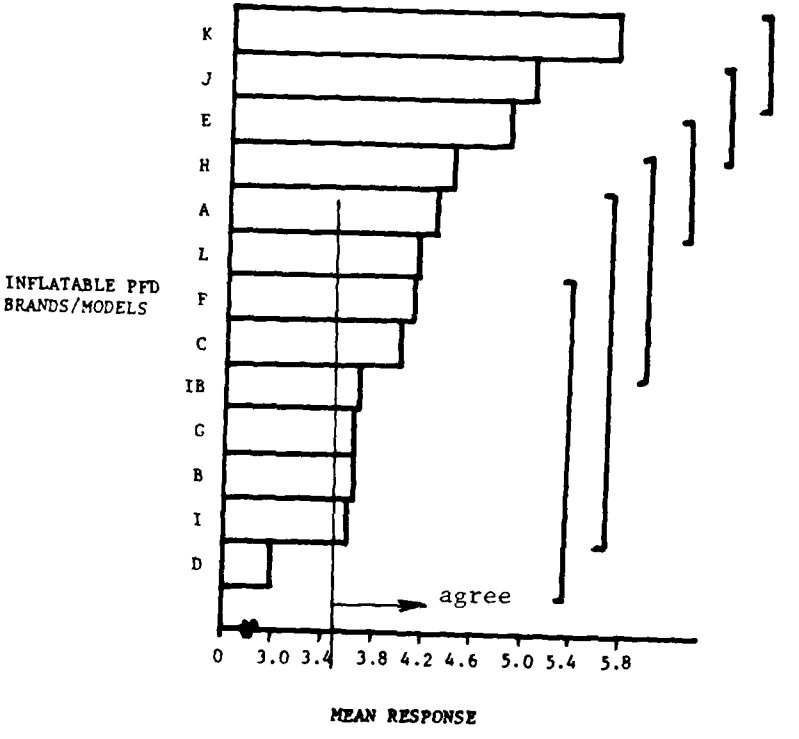
6. In a genuine boating emergency, I'd want to be wearing or using a PFD of this type.



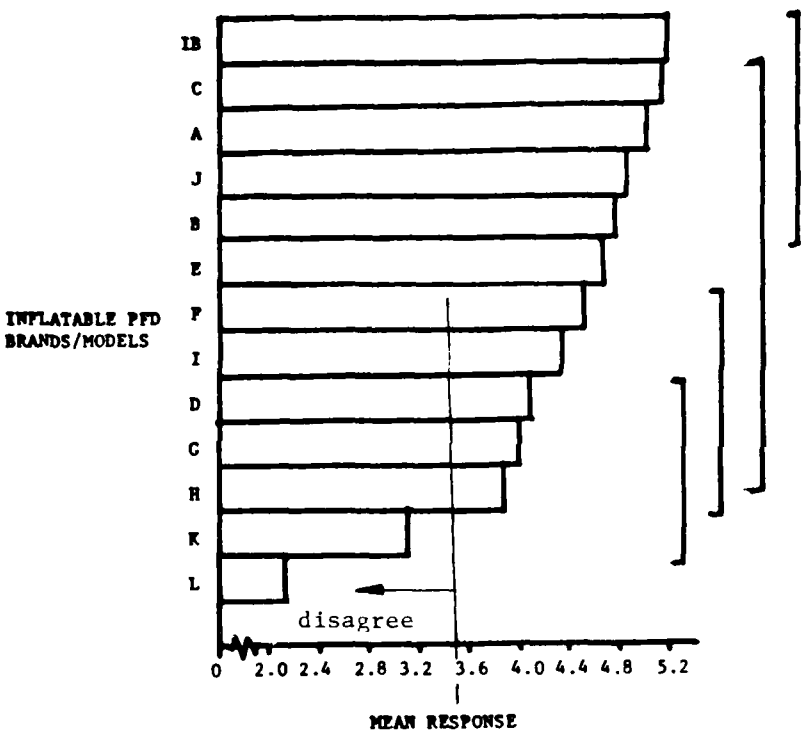
7. This PFD is not excessively hot or sweaty in warm weather.



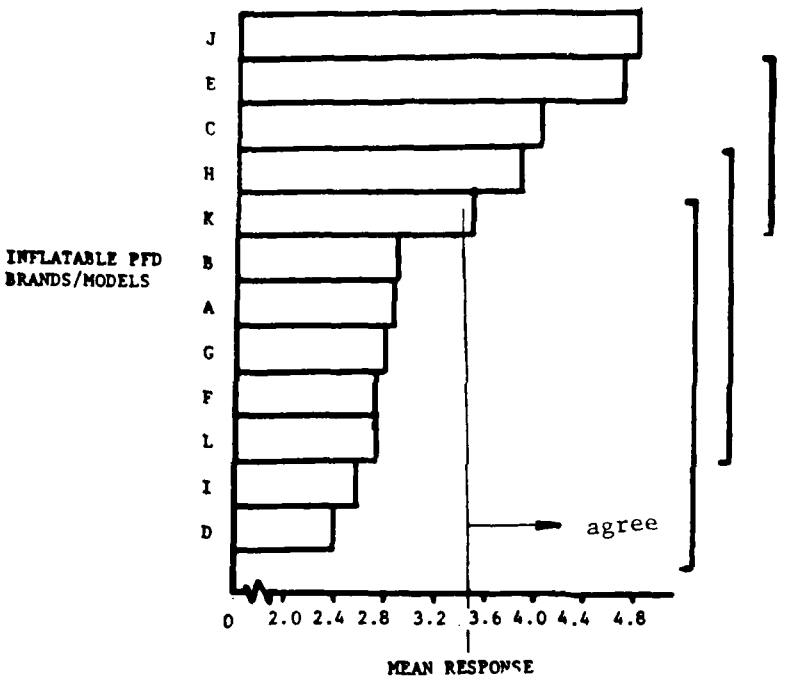
8. This PFD is useful for my boating activities in addition to providing flotation in the event of an accident.



9. This PFD does not detract from the appearance of the person who wears it.



10. This PFD looks like it would work well even in rough water.



11. If I owned this PFD, I would wear it more than I do the best of my current PFDs.

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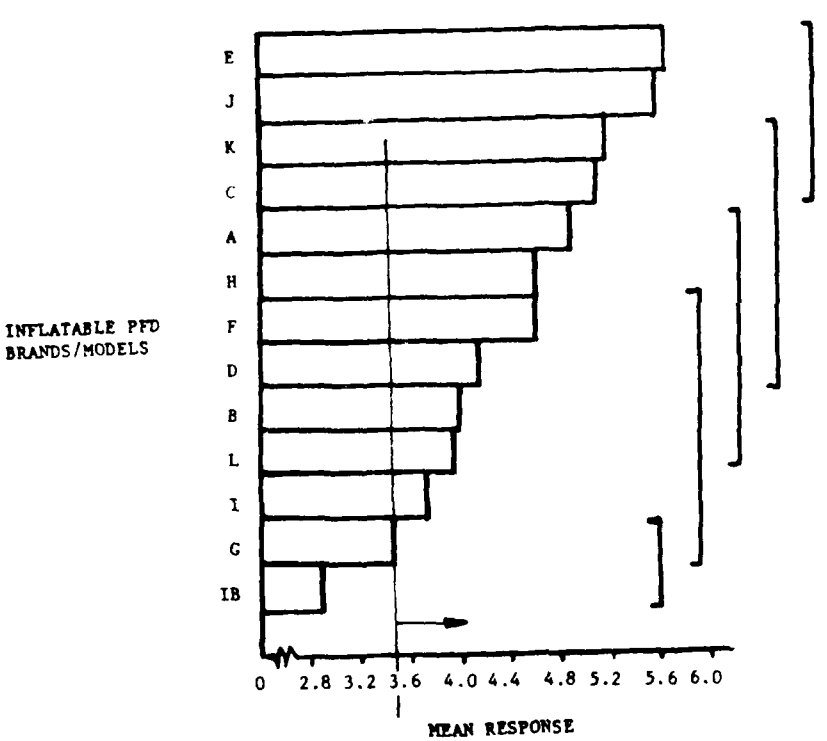
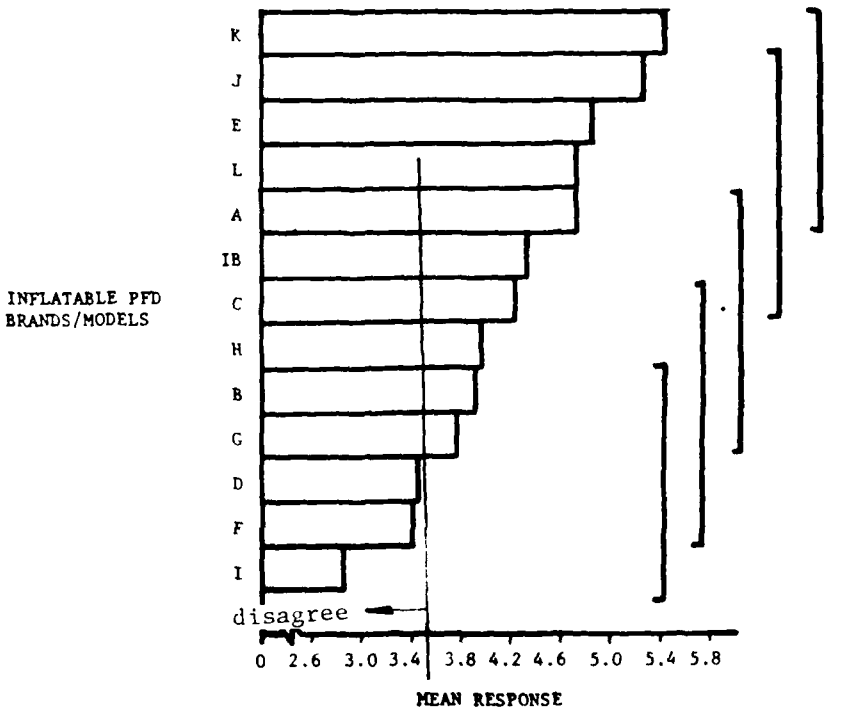


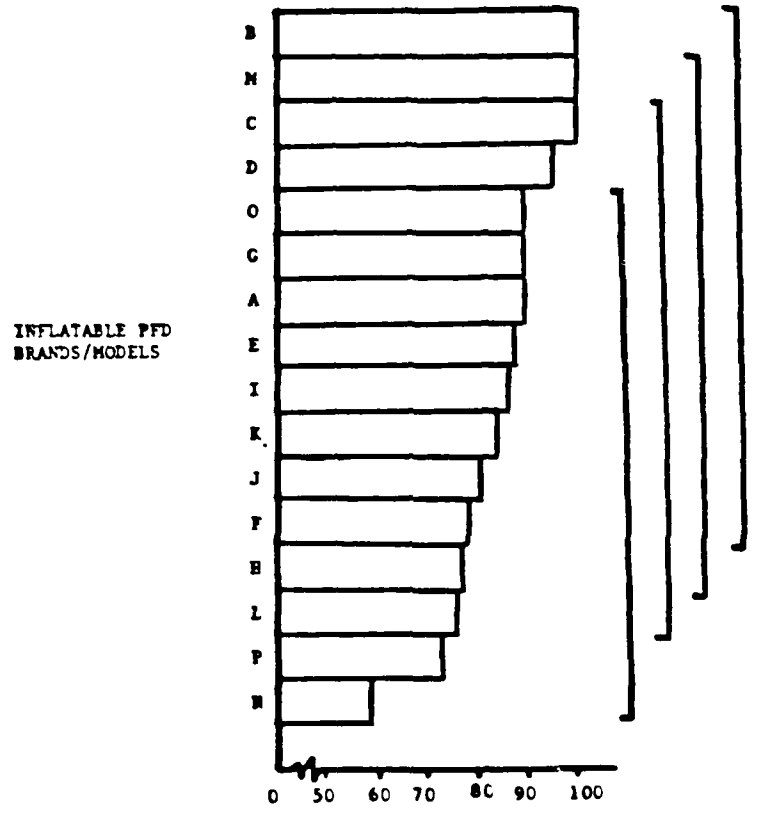
Reversed: 6 = Disagree Strongly
1 = Agree Strongly

12. This PFD feels bulky when worn.



13. This PFD does not rub, scrape, or pinch the wearer's skin.

1.a. & b.) Only inoperable events of an immediate nature are represented in the analysis of this question such as "failure of the cylinder to puncture". Relatively long-term conditions such as "device became partially deflated overnight" were eliminated from this question. This decision is reflected in answers to other questions in this study.



1.a. Did you ever go to use this device when you thought it was operable only to find that it was not? YES___ NO___

CONFIDENCE INTERVALS FOR "INOPERABLE" RESPONSES OF INFLATABLE PFD BRANDS/MODELS

In response to question 1.a., all but three inflatable PFD brands or models received a percentage of positive responses. This means that sometime during the respondent's boating season the test inflatable PFD was found to be inoperable through automatic or manual inflation means when the respondent thought it was operable. Since this study consists of samples of both inflatable PFD brands/models and users out of the entire population of these brands/models and users, there is definitely an error for the percentages obtained. The Coast Guard is 90% confident that in the total population of these PFD brands/models and their users, the "inoperable" response rate for a boating season would fall between the upper (P_u) and lower (P_L) limits shown below.
To determine the interval for all inflatable PFDs combined, PFD questionnaires that could not be identified by brand or model but contained "inoperable" responses were included.

B $P_u = .238$
$P_L = 0$

G,O,A $P_u = .429$
$P_L = .0057$

C $P_u = .283$
$P_L = 0$

D $P_u = .227$
$P_L = .0027$

E $P_u = .344$
$P_L = .023$

F $P_u = .466$
$P_L = .061$

H $P_u = .42$
$P_L = .094$

I $P_u = .363$
$P_L = .024$

J $P_u = .494$
$P_L = .095$

K $P_u = .438$
$P_L = .03$

L $P_u = .46$
$P_L = .072$

M $P_u = .259$
$P_L = 0$

N $P_u = .684$
$P_L = .181$

P $P_u = .564$
$P_L = .079$

ALL INFL. BRANDS/ MODELS $P_u = .201$
$P_L = .125$

1b) If you went to use this device thinking it was operable and it wasn't, describe the event:

I YOKES

1. (D)
   - Did not properly cock device that punctures CO2 cylinder (1)

2. (B)
   - No Event

3. (H)
   - CO2 cartridge spent-pin not recocked (1)
   - Doesn't puncture CO2 cartridge properly every time. Therefore does not fully inflate (1)
   - Went to inflate, CO2 cylinder empty, inflated by mouth (1)
   - Went in water thinking CO2 cylinder and pull cord were set. Found new cylinder had been put in but activating lever had not been put in proper position (1)
   - Jumped in water with defective cartridge (1)

4. (O)
   - Inflation valve did not function, could have been due to incorrect installation of cylinder (1)

5. (A)
   - The CO2 cylinder was not properly attached to the trigger and did not puncture. Inflated orally (1)

6. (Q)
   - The pill dissolved and was not usable at the time (1)

7. (M)
   - At present unit has a new cylinder. It cannot be removed due to corroded threads (1) (This event is not listed as an"inoperable" event in the numerical analysis)

8. (F)
   - Forgot to change cartridge (2)
   - Tried the lifejacket with the CO2 cylinder. As it filled with CO2, it deflated just as fast. Found that the oral inflation stem was locked in deflation mode (1)

9. (G)
   - After opening package could not get device over my head (1)

10. (E)
    - Replaced CO2 cartridge without setting lever (2)

11. (N)
- On first test there was a lack of buoyancy and when water seeped in the CO_2 would not operate. Had difficulty blowing the device up (1)
- Tried to inflate the PFD. No good (1)
- Cylinder would not puncture (1)
- Cylinder didn't puncture. Tried several times. Lost belt in Lake Erie - came apart (1)

12. (V)
- No Event

13. (W)
- No Event

14. (C)
- No Event

II VESTS

1. (I)
- Forgot to replace cartridge - no cartridge (1)
- I was preparing to pull the tab and found it incorrect (1)

2. (J)
- Empty cartridge when needed (2)
- Corroded zipper (1)
- Not fully inflated at different times (1)
- Zipper wouldn't work. I cleaned it and treated it with silicone. No problems since (1)
- Activating lever was in wrong position when new cartridge was installed (1)
- Put cartridge in incorrectly (1)

III BELTS

1. (L)
- Had not removed spent cartridge, thought it was full (1)
- Inflated at home, in a few hours it was deflated (1)
- PFD was installed in its' cover upside down and the pull was caught in its' cover (1)
- I replaced the trigger handle upside down and the PFD failed to inflate (1)

2. (R)
- Squeezed trigger but cartridge not seated. Failed to inflate (1)
- Device contained bad cartridge (1)

3. (K)
- Pressed release and it failed to puncture cylinder. Would not work with any cylinder (1)
- Did not inflate (never could get it to inflate) (1)

IV JACKET

1. (U)
- No event

V Automatic Inflator (P)

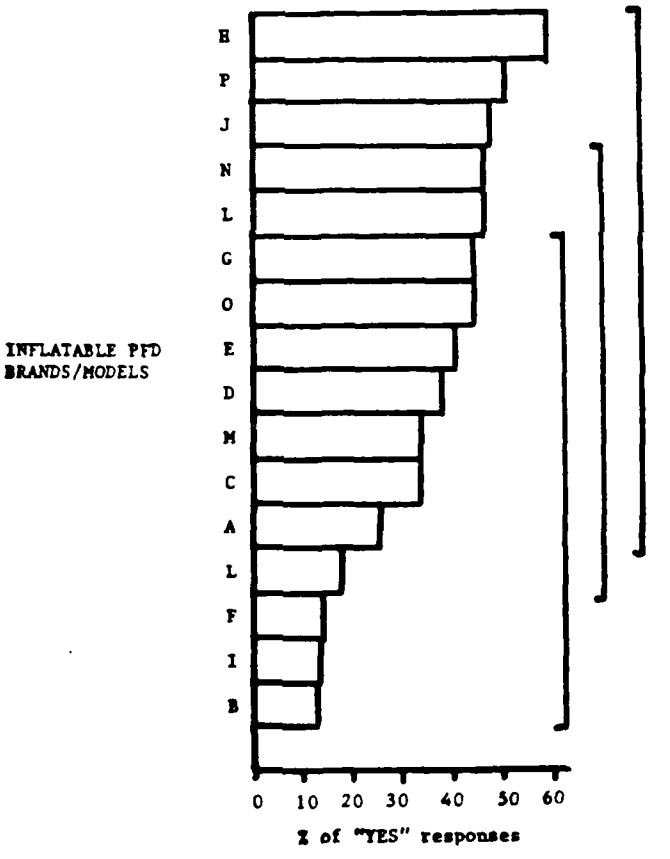
- **It had not been assembled correctly due to ambiguity of instructions (1)**
- PFD was brought out of boat through water wetting triggering device and chemical therein. When person later jumped in water it would not inflate (1)
- When I first attempted to check automatic inflation I jumped into a swimming pool and it didn't inflate. It only partially inflated when I pulled the lanyard. I found that I had not fully screwed in the CO_2 cartridge. It felt as if it had not sealed. Maybe there was a rough spot in the threads (1)

VI HYBRIDS

1. (S)
   - No event

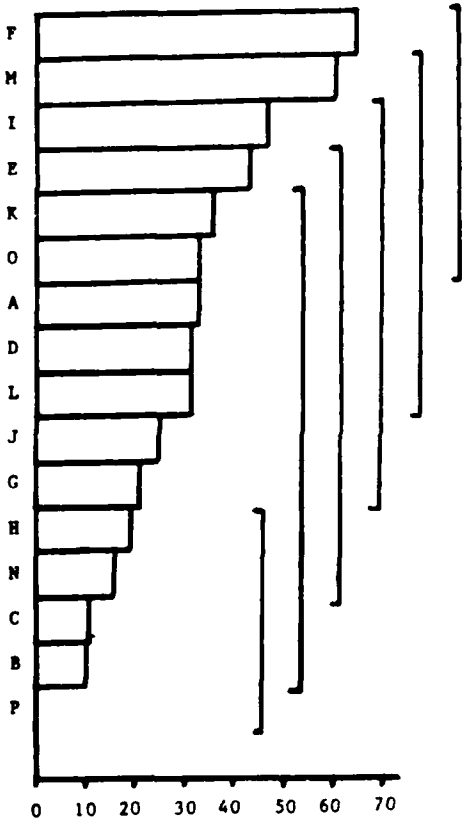
2. (T)
   - No event

2.a. The overall average maximum price survey participants would pay for inflatable PFDs is $18.00. The overall average price the Coast Guard paid for these devices for use in this field test was $37.00. These PFDs were purchased at approximately wholesale cost.



2.b. Would you buy this device at that price if it was approved only while being worn? YES___ NO___

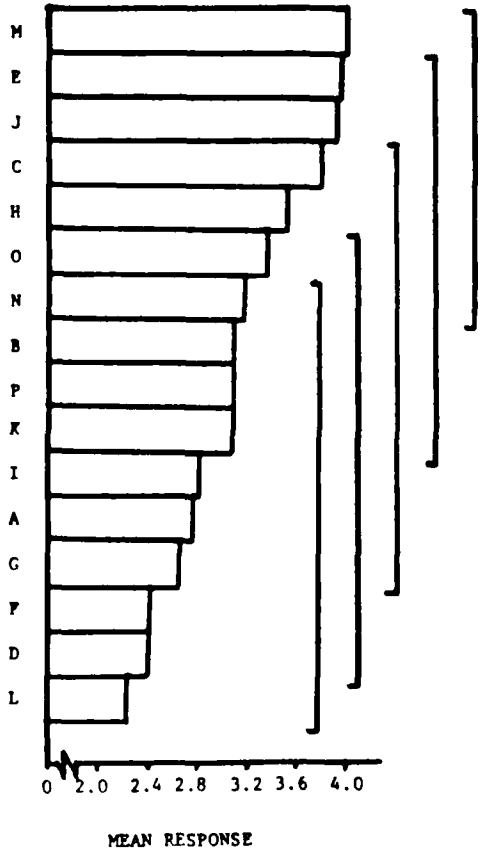
INFLATABLE PFD
BRANDS/MODELS



3. Would you feel put upon if you were boarded and asked to inflate your PFD to show that it was serviceable?
YES___ NO___

MEAN RESPONSE FOR ALL INFLATABLE PFDS - 3.15

INFLATABLE PFD
BRANDS/MODELS



4. Would you wear a device like the test PFD more often than you would your present approved PFD? (check one)
5-Much more 4-Somewhat more 3-Same
2-Somewhat less 1-Much less

5a) What one feature of this test device do you believe is most valuable?

I YOKES

1. (B)
   - Comfortable (5)
   - Less bulky (3)
   - Cooler (2)
   - Lightweight (2)
   - Whistle, when it worked (1)
   - Does not ride up (1)
   - Lifting harness built-in straps (1)

2. (D)
   - Compactness (10)
   - Good head support (head cannot go underwater) (4)
   - Can be inflated when needed (1)
   - Lightweight and comfortable (1)
   - Two separate bladders (1)
   - Dual inflation qualities (CO_2 and mouth) (1)
   - Mobility (2)
   - Life jacket better, can use pockets for fishing (1)

3. (H)
   - Less storage space required (2)
   - Can be inflated rapidly with cartridge (2)
   - Easier to swim with than inherently buoyant PFD (1)
   - Comfortable (8)
   - Easily inflated and deflated (1)
   - Body held high out of water (2)
   - Oral inflation (2)
   - Lack of bulk (2)
   - Freedom of Movement (1)
   - None (1)

4. (O)
   - Head is up (2)
   - Comfortable to wear (not bulky) (2)
   - Compactness (2)
   - Easy to don (1)
   - Superb flotation. Keeps face out of water (1)
   - Stores easily (1)
   - Lightweight (1)

5. (A)
   - Not bulky (3)
   - Comfortable when uninflated (2)
   - Ability to keep wearer's head stern to oncoming waves (1)
   - Compactness (1)
   - The inflator (1)
   - Lightweight (1)
   - Serviceable, when necessary (1)

6. (C)
   - Light and compact (3)
   - Comfortable (3)
   - Easy to stow (1)
   - Instant inflatability (1)
   - Freedom of movement when inflated (1)
   - Cool (1)
   - Size (1)

7. (Q)
   - Automatic inflation (1)

8. (M)
   - Lightweight, comfortable, easy to wear (6)
   - Self-inflating (3)
   - Highly visible in water (1)
   - Inflates as soon as PFD hits the water (1)
   - Freedom of movement (1)

9. (N)
   - Compact and comfortable to wear (4)
   - Oral inflator (2)
   - Easy to store (2)
   - Color (2)
   - Whistle (1)
   - Would be worn more often (1)
   - Easy to don (1)
   - Cooler (1)
   - Had it on and had faith it was ready (1)

10. (F)
   - Compactness (5)
   - None (3)
   - Easy to stow (2)
   - Easy to don (1)
   - Inflates quickly (1)
   - Provides excellent buoyancy (1)
   - Can be used with less interference than other types (1)
   - More comfortable to wear when uninflated (1)
   - Hold you high in water when on back (1)

11. (G)
   - Nothing (2)
   - More wearable than standard PFD (1)
   - Lightweight (1)
   - Oral inflator tube (1)
   - Easy to don (1)
   - Comfortable (1)
   - Freedom of movement (1)

12. (E)
- Not bulky (5)
- Comfortable (4)
- Lightweight (3)
- Takes up small space (2)
- Freedom of movement (2)
- No hinderance to boater handling lines, operating boat or working in tight quarters (1)
- Good buoyancy (1)
- Turns head face up (1)
- Easy to wear (1)
- Oral inflation (1)
- Good head support from collar (1)
- Self inflation (1)

13. (V)
- Comfortable (3)
- Cool (1)
- Not as bulky as Type II (1)
- Keeps head above water (1)
- Good righting moment (1)

14. (W)
- Holds head out of water better than standard PFD (1)
- Compactness (2)
- Freedom of movement (1)

II VESTS

1. (I)
- Compactness (7)
- Excellent flotation (3)
- Cooler (openess of material) (2)
- Lightweight (2)
- Freedom of movement (1)
- Easy storage (1)
- Inflated easily (1)
- Double inflation means, either of which is adequate (1)
- None (1)
- Head and face well protected from water when inflated (1)
- Less chance of snag (1)
- Good buoyancy for approx. 4 to 5 hours (1)

2. (J)
- Lightweight, comfortable (14)
- Freedom of movement (5)
- Looks (2)
- Warm and windproof (2)
- Ability to top off after inflation (2)
- Easy to put on, no strings, straps, etc. to adjust (2)
- Two methods of inflation (1)
- Easy storage (1)
- Body flotation is upright (1)
- Pockets (1)
- Better turning movement than inherently buoyant PFD's (1)

III BELTS

1. (L)
   - Compactness (5)
   - Whistle (3)
   - Ease of wearing (3)
   - More comfortable in hot weather (1)
   - Good for hunting (1)

2. (R)
   - Wearable (4)
   - Compact (2)
   - None (1)
   - Accessible (1)
   - Whistle (1)
   - Lightweight (1)
   - Easy to stow (1)

3. (K)
   - Comfortable when worn (5)
   - Compact (4)
   - Freedom of movement (2)
   - None (1)
   - Cooler (1)
   - Does not interfere with deck work (1)
   - Makes a good work backup device (1)

IV JACKET

1. (V)
   - Control of amount of flotation desired (1)

V Automatic Inflator (P)
- Being automatic (3)
- None, this PFD is not for average boater. They are for professionals (1)
- It automatically slowly inflates when it hits the water (1)
- It stands up well under conditions of sun and salt (1)

VI HYBRIDS

1. (S)
   - Whistle (1)

2. (T)
   - The high degree of buoyancy (1)
   - The uninflated built in buoyancy (1)

5b) What one feature of this test device do you believe detracts most from it?

I YOKES

1. (B)
   - Uncomfortable, hurts neck whether inflated or deflated (2)
   - Placement of CO2 cylinders causes bruises or can break ribs (1)
   - Method of tying (no D-ring) (1)
   - Needs snap type buckles (1)
   - Needs strap between legs (1)
   - Leakage of air. After 24 hours the device lost 1/3 of its air (1)
   - Reliability (1)
   - Unconscious wearer would not survive (1)
   - Rough edges on outside (1)
   - Cost and availability of CO2 cylinders (1)

2. (D)
   - Reliability (4)
   - Stiffness around neck causing soreness (3)
   - Position of CO2 cartridge (1)
   - The uninflated case (1)
   - Cannot be used as a "throwable" (1)
   - Does not inflate properly, is much to difficult to repack (1)
   - No place to carry spare bottles (1)
   - Too tight under chin, surprised every time it works (1)
   - Short life expectancy and estimated cost (1)
   - Forgetting to replace cylinder and having to buy cylinder (1)
   - Loses air after 2 or 3 hours (1)
   - Too difficult to repack (1)

3. (H)
   - Useless if person is unconscious (5)
   - Uncomfortable around neck (4)
   - Uncomfortable to wear over extended period (2)
   - Poor righting moment (1)
   - Oral inflator always poking in face (1)
   - Discomfort when inflating (1)
   - Rides up when inflated (1)
   - Must carry spare CO2 cartridge (1)
   - Pocket should be constructed for manual inflation pull handle. Could get caught accidently and inflate (1)

4. (O)
   - None (2)
   - Manual inflation trigger mechanism has to be manually returned to nonpuncturing position (1)
   - Hard to swim forward (1)
   - Hard to find CO2 cartridge style (1)
   - Should use non-corrosive buckle for waist strap instead of knot (1)
   - Should have crotch strap (1)
   - Waist strap (1)
   - Instructions should be better written (1)

4. (O) (cont.)
   - Floppy when worn deflated. Gets in way (1)
   - Cost of replacement cylinders (1)
   - Oral inflator should have no return valve (10

5. (A)
   - Too small for neck (2)
   - Not ready for use instantly (1)
   - Inability to place device on person in water (1)
   - Oral inflation tube (1)
   - Bulky (1)
   - Nothing (1)
   - Replacement of CO2 cylinders (1)

6. (C)
   - Deflates in 24 hours (1)
   - None (1)
   - Difficult to repack after use (1)
   - Cuts off circulation when inflated (1)
   - Uncomfortable in water (1)
   - Collar hurts when inflated (1)
   - Not automatically inflated (1)
   - Reliabilty of inflation (1)
   - Subject to deterioration (1)
   - Hot on bare skin (1)
   - Concern about air leakage (1)

7. (Q)
   - Pill dissolves from dampness (1)
   - Deterioration if exposed to the sun for long periods (1)

8. (M)
   - Possibility of tear or puncture (2)
   - During and after inflation, cannister gets very hot (1)
   - Tie strap and left handed zipper (1)
   - Directions are in Japanese (1)
   - No pockets (1)
   - Cylinders are hard to unscrew (1)
   - Extremely hard to close zipper while in water. Nearly impossible when inflated (1)
   - Flammable gas which inflates it (1)
   - Threads corrode making removal of cylinder impossible (1)
   - Weight of cannister (1)

9. (N)
   - Would not be tested by owner (2)
   - Hard to return to storage belt and operate (1)
   - Belt could be donned upside down (1)
   - Clumsy (1)
   - Inflation device is almost impossible to locate when needed (1)
   - Belt is useless (1)
   - Waist belt should be preset to user's body (1)
   - Hard to replace CO2 cylinders (1)
   - Bulky around waist (1)
   - Hard to replace trigger mechanism (1)
   - CO2 cylinder cannot be replaced while in water (1)
   - Trigger mechanism (1)

10. (F)
- Difficult to restore zipper for packing. Since zipper slide is not attached, it could easily be lost (3)
- Too small to go over adult head (2)
- Uncomfortable to wear. Rides up and rubs around neck (2)
- Puncture (1)
- Hot in hot weather due to plastic-like material (1)
- None (1)
- Lost zipper slides (1)
- Difficult to repack (1)
- Reliability (1)
- Must be refolded and recharged after use (1)
- Stiff hard material. Should be more pliable (1)
- In the standing position I found the device extremely uncomfortable (1)

11. (G)
- Hard to repack (6)
- Takes two people to refold into case (1)
- Gets in way when packed (1)
- Need instructions (1)
- Negative buoyancy when deflated (1)
- Cartridges expensive and hard to find (1)
- Puncture (1)

12. (E)
- It leaks (3)
- None (2)
- When dry material is stiff. Fire pin is starting to pit and rust. Pull string will not last much longer. Snaps hard to open unless lubricant is used (1)
- Lack of strength of materials causes concern over puncture (1)
- Lack of instructions for use (1)
- Cuts into neck when inflated or deflated (1)
- Has no inherent buoyancy (1)
- No hypothermic insulation (1)
- Loose container of cartridge and its trigger mechanism. If it were secured on both sides it would not bother wearer working on deck (1)
- Wearer must be instructed on methods of inflation (1)
- Unless you practice using it, you may put it on too tight, as I did the first time. In life or death situation, discomfort could make the difference. Would average person practice using jacket before they really need it? (1)
- Should have more sizes than Small, Medium or Large to fit person better (1)
- Danger of leakage (1)

13. (V)
- Weight around neck when wearing uninflated (1)
- Must depend on mechanical or manual means for inflation (1)
- Tendency for device to come over back of head in rough water (1)
- While inflating the snaps near the face open hitting you in the face with considerable force (1)
- None (1)

13. (V) (cont.)
- CO_2 cylinders not readily available (1)
- Purchase of cylinders and possible patch repair (1)

14. (W)
- Hard to repack (2)
- Its' weight (1)

II VESTS

1. (I)
- Rough around neck (8)
- Hard to return to container (2)
- Closeness of material around one's face could cause panic due to expected smothering (2)
- Orange covering over bladder is sticky and rubs off easily (1)
- In a real unexpected emergency it would not be inflated (1)
- Unconscious wearer would not float (1)
- Not able to turn head when inflated. Limited ability to see (1)
- High cost to average boater (1)
- Too hard to inflate (1)
- Difficulty in rapid donning and zipping (zipper got caught in bladder cover) (1)
- Uncomfortable (1)
- Air leakage after 4 to 5 hours (1)
- Oral inflation device not visible (1)

2. (J)
- Tending to "hike up" in water (6)
- Nothing (6)
- Zipper difficult after salt water exposure (3)
- Poor color, should use orange (3)
- Hot (2)
- Poor color, red bad for hunters (1)
- Need larger CO_2 cylinders (1)
- Some people may have problems with oral inflation (1)
- Deflating after use (1)
- Flimsy, cloth should be tougher with better collar. Strap pulled off (1)
- Fabric is delicate, easy to rip and puncture (1)
- Only one bladder, needs over pressure release valve for over-sized cartridge (1)
- Uncomfortable when inflated in water. Chafing under arms (1)
- Too hot in hot weather (1)
- Would not inflate unconscious victim (1)
- Would not inflate in an unexpected emergency (1)
- Color (1)
- Loading CO_2 cylinders in narrow pocket (1)

III BELTS

1. (L)
   - Failure to keep unconscious person's head above water (3)
   - Does not keep head and shoulders up (2)
   - Uncomfortable to wear both inflated and uninflated (2)
   - Inflatable feature (must inflate before usable as PFD) (2)
   - Procedure for changing cylinders (1)
   - No crotch strap, causes "ride up" in water (1)
   - Gets in way of coat in cold water (1)
   - None (1)
   - Directions are confusing (1)
   - The way it is worn (1)

2. (R)
   - Difficult to deflate and store in bag (1)
   - Inflation device must be put on after emergency and after inflation (1)
   - Loading and trigger mechanism (1)
   - Not as good as Type IV ring buoy. At its best it's a Type IV that can be used only when worn (1)
   - Belt needs to be adjustable to fit different sized people (1)
   - Hands would not be free (1)
   - Lack of line to secure device to you during inflation. Difficult to keep hold of as it inflates, plus it tends to slip out of case when not inflated (1)
   - Nothing (1)
   - Too large to wear as belt (1)

3. (K)
   - Difficult to repack (3)
   - Unconscious person would slip out (2)
   - None (1)
   - Don't feel secure when inflated (1)
   - Has no turning moment (1)
   - Difficult to replace cartridge (1)
   - Can slip off if upside down (1)
   - Can slip off if arms were raised (1)
   - Mechanical. No faith in emergency use (1)
   - Hope it will inflate when button is pushed (1)
   - Could not be inflated by injured or unconscious person (1)

IV JACKET

1. (U)
   - For those who panic flotation amounts need to be fixed. In the case of a non-swimmer or casual boater I would prefer either the CO2 cartridge or the inherently buoyant PFD (1)

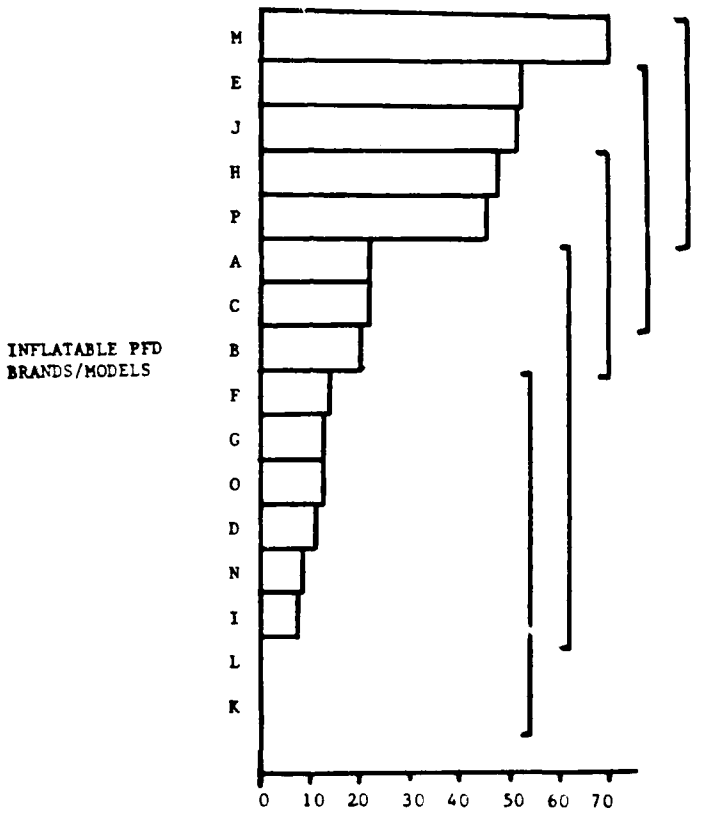
V Automatic Inflator (P)
- Have to recharge it after each use (1)
- None (1)
- Looses air over 24 hour period (1)
- I find it almost impossible to turn belly down to swim (210 lbs.). Am afraid it may be discarded in the water by a person trying to foolishly swim to shore, as happen with approved PFD's (1)

V Automatic Inflator (P) (cont.)
- Too complicated, when inflation is lost. Not serviceable as the approved PFD's (1)
- Need for maintenance (1)
- The principle behind its' technology is too complicated (1)
- Trigger device is subject to malfunction when exposed to water or dampness (1)
- It is difficult to be certain that the CO2 cartridge and red button are properly installed to assure proper inflation, whether automatic or manual. If someone didn't follow instructions and tried to reuse the red button, it doesn't inflate properly (1)

VI HYBRIDS

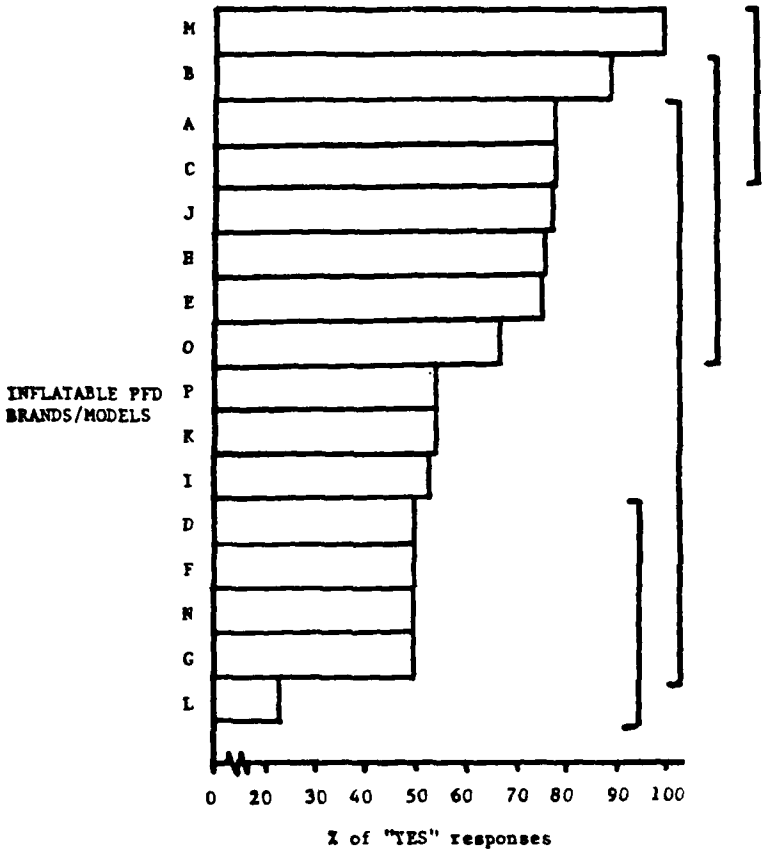
1. (S)
   - Too small head opening (1)

2. (T)
   - Difficulty in fastening the straps. No diagrams are given (1)
   - No easy way to deflate it (1)
   - No instructions (1)



6. If you had guests aboard who were not familiar with boats which type of device would you be more likely to show them how to use?

Inflatable test PFD _____ Your Customary PFD _____



7.a. Do you trust this device to perform adequately if called upon in an emergency?
YES___ NO___

7b) Why You Didn't Trust Device

I YOKES

1. (a)
   - Don't trust it in an emergency (1)
   - Don't like the fact that if it's orally inflated, manual inflation is dangerous (1)
   - Any inflatable could malfunction, CO2 cylinder, leak in seams, check valve fail to hold, bladder material could tear or puncture (1)
   - Leakage of air (1)

2. (D)
   - Too complicated to inflate, often does not completely come out of casing (1)
   - Air bladder is too flimsy for rough water. Both lost pressure after 4 hours (1)
   - Puncture in bladder might not inflate (2)
   - Came out the neck in choppy water (1)
   - Will slide up around head from impact of hitting water. Causes pressure and pain on the rib cage when swimming (1)
   - It may leak to dangerous point after 2 or 3 hours. Leaked totally after 12 hours (3)
   - CO2 cylinder may not work, person may panic and not know how to work the device (1)

3. (H)
   - Questions whether inflation mechanism would function properly (3)
   - Only one air compartment puncture may occur especially during emergency (1)
   - CO2 cylinder may not be serviceable (1)
   - Hard to don in water (1)

4. (O)
   - Puncture renders PFD useless. Don't trust device although more wearable. Wonder if average person could keep gas available to inflate. Possibly panicky or injured person may not orally inflate PFD (1)
   - Tie strap should be redesigned to either a two strap system or a single wider strap. When worn in water any length of time, the present strap cuts into the small of the back (1)

5. (A)
   - May not inflate or may leak (1)
   - Needs instructions (1)
   - Ability to check out PFD within few minutes. Requires visual check of CO2 unit and check for leaks underwater of inflatable (1)
   - As long as I personally check CO2 cylinder (1)

6. (C)
   - Rough use or improper storage could produce holes. What about a self-sealing compound inside (1)
   - Concern over air leakage and quality of pull cord (1)

7. (Q)
   - It may not be charged (1)
   - Dissolved pill (1)

8. (M)
   - Worked well until cartridge became stuck (1)
   - Will not turn over unconscious person (1)

9. (N)
   - Donning it and inflating takes time and may be confusing in an emergency (1)
   - When testing was very unaware at all times, wore my conventional PFD under this device (1)
   - PFD may not inflate fully or at all (1)
   - Because cylinder will not always puncture and it has to be blown up (1)
   - Unreliable (1)

10. (F)
   - Defective cylinder (2)
   - Too much chance of leak (2)
   - In real emergency you would not have time to orally inflate if CO2 bottle leaked out with time or if you were injured entering the water (1)
   - The pull cord may get stuck (1)
   - Device may have been perforated when stored (1)
   - Mechanical failure of inflation unit (1)
   - Device leaked air the second time it was used. Possibility of large leak (1)
   - So tight around neck it could choke you (1)
   - Bladder inflates to point where there is no visibility (1)

11. (G)
   - Takes too long to don (1)
   - If you are unconscious you will not be held up (1)
   - Only trained people would know how to use this PFD (1)
   - Cannot get over head (1)
   - Hard to get on particularly when not completely deflated (1)
   - Does not fit well around waist (1)
   - It requires that you do something to make it float (1)

12. (E)
   - If it were put on too tight it would tend to hold person's head down in the water. An inexperienced swimmer or unconscious person would be in trouble (1)
   - Puncture or tear (1)
   - Comes over top of head in rough water (1)
   - It leaks (2)
   - People may not prepare it for storage (1)

13. (W)
   - No Comments

14. (V)
   - No Comments

II VESTS

1. (I)
   - Would distrust any active device due to possible malfunction: empty cartridge, bad firing mechanisms, poor cartridge seal, hard trigger mechanism for women and children, punctured or broken chambers (2)
   - Inability to inflate because user was unconscious (2)
   - Rapid deflation of CO2 (12-24 hours, not so with air) (2)
   - In explosion it would not inflate (1)
   - CO2 cylinder leaked and was not able to inflate one side when pulled (1)
   - Oral inflation after CO2 deflation is difficult because of extreme pressure required (1)
   - Unreliable (holding of air) (1)
   - No indicator for full cylinder (1)
   - Cannot tell if bladder is damaged (1)

2. (J)
   - Puncture (2)
   - Corroded zipper, loss of air (1)
   - Others may not know how to use mechanical device (1)
   - Need inherently buoyant PFD for backup but there may not be time to use it (1)
   - No reason (1)
   - No reason as long as it is kept in good condition (1)
   - Needs to be reinflated after several hours of inflation (1)
   - Don't trust cartridges (1)
   - Injured person may not be able to inflate device (1)
   - Need to rely on memory as to last time CO2 was replaced (1)

III BELTS

1. (L)
   - Pull knob can be inserted backward and nothing would work (1)
   - Cylinder must be full, activator must puncture cylinder, must have mechanical action not required by regular PFD (1)
   - No way to check cylinder before using without disassembling (1)
   - Need assistance to turn face-up (2)
   - Does not inflate for unconscious wearer (2)
   - Puncture possibility during storage (2)
   - Supports waist but not head and shoulders (1)
   - Do not feel safe and secure with waist type device (1)
   - Leakage or air or CO2 (2)
   - Don't trust trigger device (1)
   - Don't like waist worn device. Never know which end they are going to bring up (1)
   - Wouldn't keep you afloat for a long period (1)

2. (R)
   - Very hard to replace cartridge correctly (as it must be done inside inflation tube) and to seat cartridge (1)
   - The difficulty in triggering the mechanism makes it unreliable (1)
   - Handle for cylinder not in fixed location. Hard to locate in emergency (1)

3. (K)
   - Does not keep head out of water, can slide up (1)
   - If an emergency, if far out to sea, forget it (1)
   - No straps to hold it to wearer (1)

IV JACKET

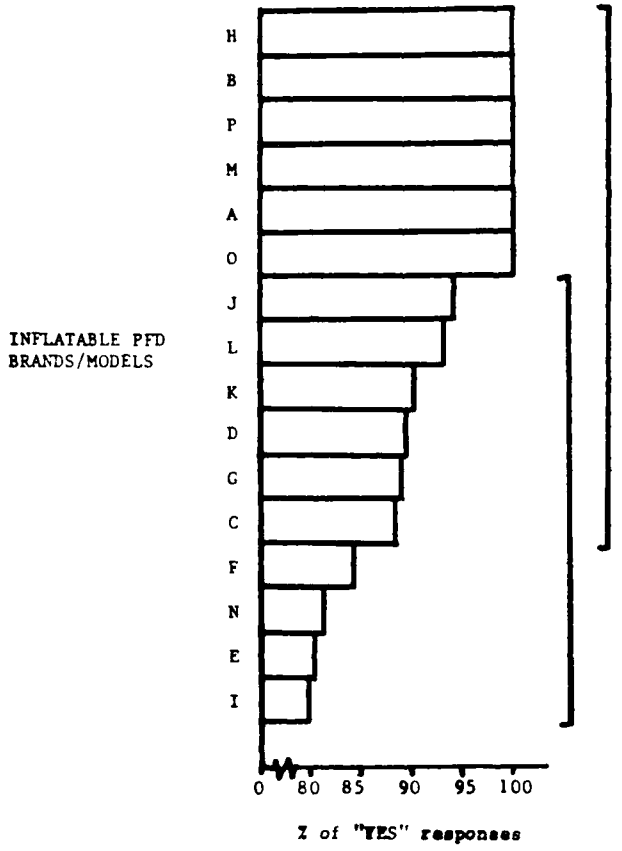
1. (U)
   - No Comments

V Automatic Inflator (P)
- There would be too much explaining of instructions in an emergency and there is always the chance that the inflation system won't work (1)
- Neglect on part of owner to maintain and service device (1)
- No automatic device should be trusted with your life (1)
- In an emergency, the less reasoning one has to do and the less manipulating, the better (1)
- Unreliability of triggering device (1)
- Have found out about idiosyncrasies of inflation system. I could be 99% sure I had installed CO2 cartridge and red button, but 1% uncertainty would worry me. But I'd rather be wearing this device than no PFD in an emergency (1)

VI HYBRIDS

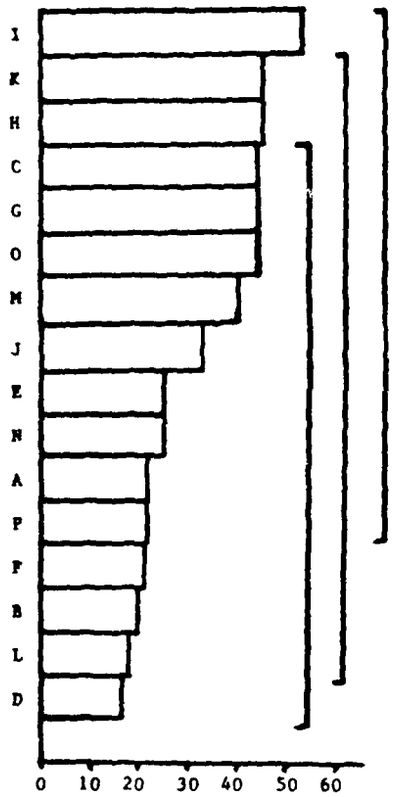
1. (S)
   - Too difficult to don (1)

2. (T)
   - No Comments



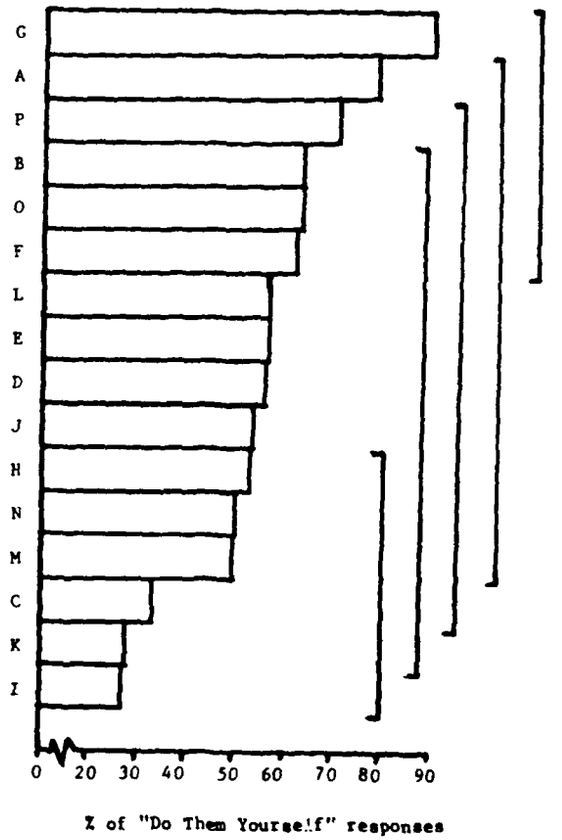
8. Is the test device in good enough condition to last another boating season? YES___ NO___

INFLATABLE PFD
BRANDS/MODELS



9.a. Would you be willing to pay a servicing facility to inspect the device? YES___ NO___

INFLATABLE PFD
BRANDS/MODELS



9.b. Assuming repairs were necessary, would you rather. . . _____ do them yourself?
_____ have the servicing facility do them?

10a) Most people out boating do not wear PFD's all of the time. If you are one of these people, what is your main objection to wearing your approved PFD's?

I YOKES

1. (B)
   - Hot (4)
   - Bulky (4)
   - Freedom of movement (3)
   - Uncomfortable (2)
   - Would not wear unless danger of going overboard in rough weather or operations (1)

2. (D)
   - Bulky and hot (8)
   - Uncomfortable (6)
   - Lack of freedom unless underway, then the constant wearing would be proportional to weather and sea conditions or tasks to be performed (2)
   - Chafing (2)
   - Lack of mobility (1)

3. (H)
   - Uncomfortable when hot, when cool prefer Type III which serves as a jacket (1)
   - Too hot and bulky in warm weather and extended period (12)
   - Restricts movement (2)
   - Prefer float coat, wear it all the time (1)
   - Unattractive appearance (3)
   - Does not fit women well in chest area (1)
   - Wear PFD only when dangerous conditions exist (1)

II VESTS

1. (I)
   - Bulky (7)
   - Hot (6)
   - Uncomfortable (5)
   - No objection in a dangerous situation (2)
   - Sticky (1)
   - Hangs up on lines and rigging (1)

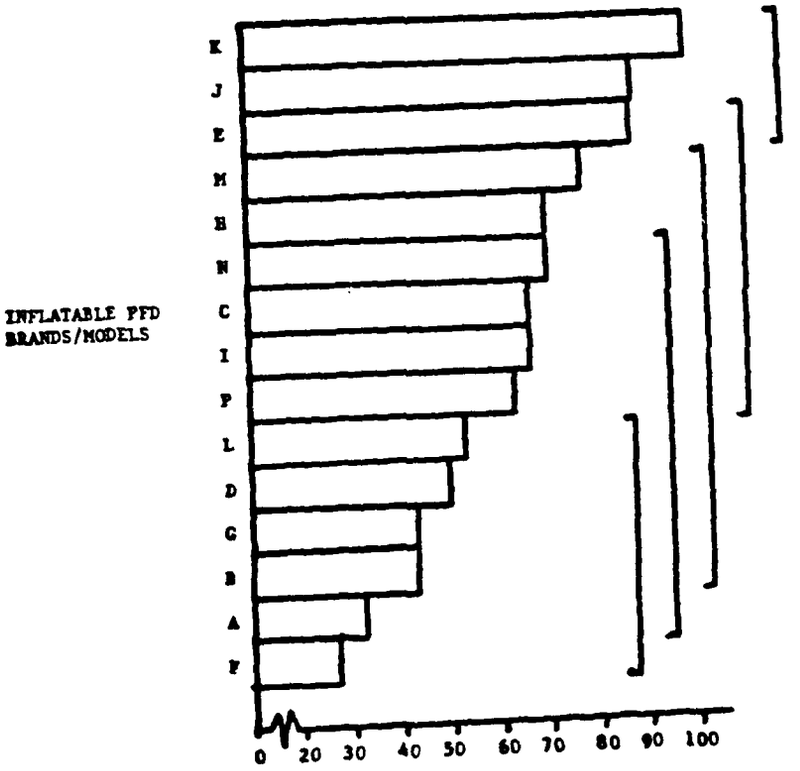
2. (J)
   - Bulky (16)
   - Uncomfortable (14)
   - Hot (8)
   - Restricts movement (4)
   - Suntan (1)
   - Awkward at chart table (1)

III BELTS

1. (L)
   - Hot and bulky (7)
   - Does not keep inflation overnight (1)

1. (L) (cont.)
   - Lack of freedom of movement (1)
   - Only use in bad weather or working on deck (1)

Note: Comments on this question for the remaining PFD's in this study are similar to those mentioned above. Therefore it was decided that no further listing of comments was necessary.



0 - not a sufficient number of responses to this question.

10.b. Does the design of the test device overcome this objection? YES____ NO____

10c) If yes, what aspect of the test device is responsible for overcoming your objection?

I YOKES

1. (B)
   - Comfort (2)
   - Not bulky (2)
   - Light (1)
   - Cool (1)

2. (D)
   - Lightweight and fits loosely until inflated (2)
   - Less bulky and non-constricting (4)
   - Cut away design (1)
   - Would have to be individually tested by manufacturer with a written certification attached to every PFD (1)
   - Compact when not in use (1)

3. (H)
   - Not bulky when deflated (2)
   - Flat and non-irritating to neck (1)
   - Not heavy and somewhat nice looking (1)
   - Easy to use (1)
   - Comfortable and efficient when required (3)

4. (O)
   - Light and comfortable to wear uninflated (3)
   - Light enough not to be hot (1)
   - Absence of bulky neck piece eliminates neck chafe (1)
   - Not bulky when uninflated. More freedom of movement (1)
   - Inflate only when needed (1)
   - Easy to inflate by mouth if necessary (1)
   - Easily stored (1)

5. (A)
   - Not bulky (3)
   - Lightweight (2)

6. (C)
   - Not bulky (4)
   - Freedom of movement (1)
   - Comfortable to wear (1)
   - Easy to don quickly (1)
   - Less body covered by device (1)
   - Compactness (1)

7. (Q)
   - Not bulky (1)

8. (M)
   - Lightweight (3)
   - Freedom of movement (3)
   - Not bulky (3)
   - Comfortable (2)
   - Low collar height (1)
   - Comfortable to wear overboard (1)

9. (N)
   - Cooler (3)
   - Like wearing a belt (2)
   - Less bulky (2)
   - Comfortable (1)
   - Lightweight (1)
   - Out of the way but with you at all times (1)

10. (F)
   - Less bulky (1)
   - All aspects (1)

11. (G)
   - Compact (2)
   - Doesn't cover up torso until used (1)
   - Easy to wear (1)
   - Freedom of movement (1)
   - I can carry it always although not wearing it. At first sign of impending emergency, I would don it immediately (1)

12. (E)
   - Less bulk (7)
   - Comfortable (4)
   - Lightweight (4)
   - Is not tight around body (3)
   - Freedom of movement (2)
   - All aspects (1)
   - Doesn't go all around body (1)
   - Design and material (1)
   - When inflated PFD fits snuggly around body (1)
   - Oral inflation (1)

13. (V)
   - Freedom of movement (3)
   - Compact (2)
   - Cool (1)
   - Comfortable (1)
   - Lays flat on shoulders, not up around neck and ears (1)

14. (W)
   - Compact (3)
   - Inflates automatically (1)

II VESTS

1. (I)
   - Webbed material is cooler (1)
   - Less bulky (6)
   - Much more easily worn than Type I or II kapok standards (1)
   - Freedom of movement (1)
   - Smooth bladder prevents snagging (1)

2. (J)
   - Lack of bulkiness when deflated (9)
   - More comfortable, lightweight (10)
   - Relati.ely cool (3)
   - Fits like regular jacket (5)
   - Looks (6)
   - Inflates and deflates easily (hardly used cylinders) (1)
   - More mesh needed for more air (1)
   - Reliable (1)
   - Webbing in back, pockets (1)

III BELTS

1. (L)
   - Compactness (8)
   - Freedom of movement (5)
   - Fits around waist (3)
   - Jacket may be worn over device for more warmth (1)

2. (R)
   - Compact (4)
   - Fits on waist (2)
   - Weight (1)
   - Freedom of movement (1)
   - Easy to wear but men and women don't often wear belts in summer (1)

3. (K)
   - Worn like a belt (5)
   - Comfortable to wear uninflated (2)
   - Compact (2)
   - Light (2)
   - Easy to inflate by mouth (1)
   - Cooler (1)

IV JACKET

1. (U)
   - Worn as jacket with slight amount of air makes it comfortable for spring, fall and some winter boating (1)

V Automatic Inflator (P)
- None concerning automatic inflator (1)

VI HYBRIDS

1. (S)
   - No Comments

2. (T)
   - No Comments

11a) The one event that made you least favorably inclined towards the test device.

I YOKES

1. (B)
   - None (2)
   - Placement of CO2 cylinder (1)
   - No "D" ring (1)
   - When inflated by cylinder bladder throws back the neck, pushing the manual inflater into the face, causing discomfort (1)
   - Adjustment straps are too intricate (1)
   - Too bulky (1)
   - Valve hard to pull when cold, it may freeze (1)
   - The canvas and rubber caused sweating (1)
   - Loss of air over 24 hours (1)
   - PFD tends to ride up on neck if not inflated correctly (1)

2. (D)
   - Fits around neck like horse collar (5)
   - Removing from female without deflating (1)
   - Need larger size, did not fit (1)
   - To complicated to instruct newcomers, does not always inflate properly and too difficult to repack.
   - Soreness around shoulders after several hour period (1)
   - Children would take off device as soon as permitted (1)
   - Need better straps to hold device on body (1)
   - None (1)
   - Lost air (1)
   - One occasion it felt like it would float me face down (1)

3. (H)
   - Rides up and very uncomfortable (2)
   - Slips up around chin, does not turn large person face up without assistance (2)
   - Loses air within 24 hours (2)
   - Straps too tight (1)
   - None (1)
   - Chafing around neck (1)
   - Unable to inflate due to accident (1)
   - Don't know whether it would inflate next time (1)
   - Oral inflator leaked air (1)

4. (O)
   - The triggering device must be returned manually to non-puncturing position. If not, it will puncture a new cartridge as it is inserted (1)
   - Had trouble finding large enough CO2 cartridge. They are not shelf items. Must be ordered (1)
   - Would not stay inflated overnight (1)
   - No event (1)
   - One CO2 cylinder did not inflate PFD. Had I gone overboard I probably would not carry extras. Hard to blow air underwater or with water in face. What about panic or injury (1)

4. (O)
   - Strap cutting into back in water (1)
   - Failure (either mechanical or operator) of inflation valve assembly (1)
   - Did not know how to deflate device to get it off. Failed to read instructions (1)

5. (A)
   - Necessity to inflate (1)
   - Jumped in water with device hand held in simulated fire and explosion. Almost impossible to place unit over head and secure around waist. A good floater and swimmer, it took almost 5 minutes to get unit properly secured and inflated. What about non-swimmer in same situation (1)
   - Deflated in 24 hours (1)
   - Fear of snag when aboard small craft in close quarters (1)
   - Did not fully self-inflate in water. Unconscious person would be in trouble (1)
   - When inflated visibility is impaired (1)
   - Head opening too small, had to struggle to don (1)
   - Difficulty in getting to trigger and attaching CO2 cylinder (1)
   - I neglected to insert blow up capsule. It did not respond as expected (1)

6. (C)
   - When CO2 cylinder is used to inflate, all the snaps do not pop open (1)
   - No event (1)
   - When inflated it is uncomfortable, cuts off circulation (1)
   - Wearing next to skin on a hot day produced chafing and irritation lasting 4 days (1)
   - Left rubbing spot on back of neck for a long time (1)
   - Device does not stay fully inflated for 12 hours (1)
   - Unreliable for long periods of time due to air leakage (1)

7. (C)
   - Instructions were complicated - difficult to understand (1)
   - In test conducted at Peterson AFB Life Support Equipment Section, CO2 cylinders were overweight resulting in over pressure of device. If residual CO2 remained in bladder, rupture could result (1)
   - Dampness will dissolve the pill (1)

8. (M)
   - Would not turn subject face (3)
   - Puncture or tear and not knowing (2)
   - No event (1)
   - Has tendency to ride up. Not enough adjustment to keep device in place. Inflation cartridge becomes uncomfortable worn next to bare skin - left an imprint on skin, like a burn (1)
   - Cylinders were hard to unscrew. Vaseline would have helped (1)
   - All directions Japanese. Only recently learned how to orally inflate (1)
   - Could not close zipper in water (1)
   - Cartridge cannot be removed due to corrosion without possible damage to device. Unit can be orally inflated (1)
   - Used cartridges were lighted with match and burned for some time. Gas is capable of explosion near boat fire. Should be non-flammable (1)
   - Cylinder was hot (1)
   - Lost considerable inflation after 24 hours (1)

9. (N)
- Almost impossible to repack (2)
- Hard to find CO2 release lever (2)
- Difficulty in puncturing cylinder (2)
- When repacking, I reinflated cylinder (1)
- Caused discomfort under clothing (1)
- Cylinder moves around when device is worn (1)
- Belt came off while in water (1)
- Removing and installing CO2 cylinders (1)
- Plunger did not puncture top of CO2. It was either broken, bent or not in place (1)
- Inflator hard to use - must squeeze too hard. Trigger needs improvement (1)
- Too tight for large 44" waist person (1)
- Trigger mechanism difficult to operate with one hand (1)

10. (F)
- Extremely difficult to repack (4)
- No event (2)
- When inflated, it became huge and in the way (2)
- Extremely uncomfortable (2)
- Should be ready at all times which doesn't mean folded in pouch (1)
- Zippers impossible to use (1)
- Difficult to turn over in a swimming position (1)
- No instructions for repacking. Folding instructions would need to be kept aboard boat (1)
- Development of a leak (1)
- Zipper had to be lubricated to use (1)
- Rubs when inflated (1)
- Rides up in water (1)
- Small neck hole caused chafing when uninflated (1)

11. (G)
- Repacking is difficult (3)
- Container caught in ship's wheel (1)
- Deflating device (1)
- Replacing cartridge is difficult (1)
- In floods was wearing chest waders. The device was strapped to waist. It was cumbersome inside waders and impossible to get to in an emergency (1)
- Hard to don and adjust straps (1)
- Poor fit (1)
- Loosing it (1)
- Couldn't find the right size CO2 cartridges. Must order them (1)
- Rip cord got caught on something in boat and inflated (1)

[illegible] (E)
- None (1)
- Irritated back of neck when worn (1)
- [illegible] freeze (1)
- [illegible] extra cartridges (1)
- [illegible] may not work readily (1)
- [illegible] over 12 hours (1)
- [illegible] not inflate (1)

12. (E) (cont.)
- Deflated completely within a few hours (1)
- Deflated halfway within one hour (1)
- Complete lack of instructions. Caused two misunderstandings. First, had to learn that oral inflator needed to be depressed to work. Secondly, trigger must be reset after each use (1)
- Attempted to inflate PFD using CO2 cartridge. Did not inflate because lever was not in proper position. Had previously used PFD and replaced the cartridge but had not returned the lever to the up position. On down position the lever will not puncture cartridge (1)
- Rubs neck when inflated (1)
- Changing CO2 cartridge (1)
- Life of vest is too short (1)

13. (V)
- Poor fit around neck (1)
- Malfunction of inflation assembly or injury or panic could cause failure of device (1)
- Upon inflation, the snap closest to my face popped, striking my hand and face (1)
- Device rode up over back of head in rough water (1)
- None (1)
- Inflated device was cold for short time on bare chest (1)
- When inflated it fit tightly around the neck (1)
- Deflation over night when impressed by 14 lbs. (1)
- Almost choked me when inflated (1)

14. (W)
- Hard to repack (1)
- Hard to get out of its jacket (1)
- When leaning over side of boat, rail got caught between device and body (1)

II VESTS

1. (1)
- Neck uncomfortable (4)
- If bladder not replaced in certain way sometimes only one will open when inflated (1)
- Zipper is awkward, needs metal clips (1)
- Inability to move freely when fully inflated (1)
- Inflation popping noise scared youngsters, became accustomed later (1)
- On second inflation the cartridges were not seated tight enough, so units deflated overnight to 1/4 full (1)
- While wearing PFD, velco loosens causing the inner inflatable pocket to protrude making it possible to rip (1)
- Too hard to inflate, pull cord several times in pool before it finally inflated (1)
- Difficult to get both arms in quickly and easily (1)
- Difficult to get up due to "S" curve at bottom (1)
- Unconscious person will not survive (1)
- Device hard to repack (3)
- Not the right size (1)
- Lost most of air from morning to late afternoon (2)
- Right side oral inflator did not let air out (1)

2. (J)
   - None (10)
   - Pockets filled with water (2)
   - Test jump; device nearly came off over my head (1)
   - Need nylon zipper, brass zipper corroded (2)
   - Lack of crotch strap causes ride up (3)
   - Had difficulty with first inflation, had to get used to procedure (1)
   - Back of neck sore (1)
   - Trouble finding correct CO2 cylinder for different PFD's (1)
   - Did not stay fully inflated after 24 hours (1)
   - Hard to get to CO2 mechanism (1)
   - An unconscious person would not float (2)
   - First time in use device deflated too quickly because cartridge was not on tight enough (1)
   - Too hot in the summer (1)
   - Accidental pull (1)
   - Clumsy to orally inflate (1)
   - Ability to install new cartridge in a manner whereby the device wouldn't work (1)
   - Empty cylinder (1)

III BELTS

1. (L)
   - Loss of air after 24 hours (4)
   - Had repacking problems (2)
   - Does not keep unconscious victim's head above water (2)
   - It is a nuisance to change and carry CO2 cylinders (2)
   - Changing CO2 cylinder is too much for "Sunday" boaters. Mouth valve cannot be depended on after an emergency. Too much confusion, especially if subject is in the water (1)
   - Showed test unit to others in water, found he had not replaced CO2 cylinder (1)
   - Gets in the way on a crowded vessel. Device offers no rib protection in rough weather (1)
   - Does not give complete safety in a serious situation. May be good for spectators (1)
   - Tightness around waist (1)
   - Doesn't float person safely (1)

2. (R)
   - Difficult to inflate device in deep water for a non-swimmer (1)
   - Boy, age 10 could not stay inside unless he consciously kept himself inside the ring (1)
   - An experienced person found it impossible to trigger the mechanism (1)
   - Difficult to find trigger in packed state (1)
   - Easy to slip out of ring. Unconscious person would be in trouble (1)
   - Device slipped out of case without opening velcro fasteners (1)
   - Lack of proper instructions and missing belt (1)
   - Found it hard to don when inflated (1)
   - Too hard to use as belt as described by literature (1)

3. (K)
   - No turning moment (2)
   - The closure (screw in) on the tube has to be screwed in tighter than I accomplished manually to properly hold air (1)
   - When jumping in the water after depressing the CO2 tubes, the device would throw your arms up in the air and end up around around your neck (1)
   - None (1)
   - Removing the spent cartridge and replacement with a fresh one (1)
   - Repacking (1)
   - The fact that it may slip off (1)
   - Device would slide toward feet when tried in a panic situation (1)
   - Need automatic inflation (1)
   - Uncertain what effect would be if inflated under heavy clothing (1)
   - Would not function in test. Pressure type trigger pin not recommended. Made for right handed person. Would be difficult to inflate if right hand was injured (1)
   - One of the CO2 cylinders did not puncture well making a small hole that took a long time to fill the PFD (1)
   - Use of device did not provide warmth to wearer (1)

IV JACKET

1. (U)
   - In very cold weather the jacket is not large enough to fit over numerous layers of clothing. Material doesn't allow for stretching (1)

V Automatic Inflator (P)
- During assist, boat with open aft end became awash with 8-10 inches of water. My PFD was floating in the mess when it suddenly inflated. We managed to retrieve it but this is not good when you consider more often then not PFD's are worn in wet and miserable conditions. It is not good to have the vest inflated except upon need (1)
- Leaked air in less then 19 hours (1)
- None (2)
- Probably too expensive for an automatic device that may be undependable for lifesaving (1)
- Would not hold air for 24 hours (1)
- Need for recurrent maintenance is undesirable (1)
- First inflation, I thought I had been shot in the chest (1)
- Triggering device is unreliable. A novice may not have presence of mind to orally inflate in water (1)
- Not sufficiently comfortable to wear all the time. I wonder if automatic inflation mechanism would get triggered by spray or rain during heavy weather when we put on PFD's. I was unable to check this out (1)
- Vest inflated while being showered by hose which means that spray could inflate vest. (Has velcro strap protecting auto inflation bobbin) (1)

VI HYBRIDS

1. (S)
   - Difficult to don

2. (T)
   - Difficulty in arranging and trying the straps (1)
   - Device is extremely bulky when inflated (1)

2. (T) (con't)
- When wearer is retrieved from the water the PFD is difficult to deflate and remove (1)

11b) The one event that caused you to think most highly of this device.

I YOKES

1. (B)
- Comfort (3)
- Good turning moment (1)
- Lightweight (1)
- Easy to store (1)
- Can wear it under light jacket (1)
- Keeps body upright (1)
- Can inflate quickly in an emergency (1)
- None (1)
- Freedom of movement (1)
- Held air for several days (1)
- Compact (1)

2. (D)
- None (3)
- Lightweight and compact (5)
- Freedom of movement (2)
- Very durable (1)
- Cannot float face downward (1)

3. (H)
- Easy to don and comfortable. Just as safe as inherently buoyant (2)
- More buoyant and lighter then regular type II or III (1)
- Very wearable and attractive compared to other PFD's (3)
- Light, easy to inflate and comfortable (1)
- Keeps unconscious person's head out of water (1)
- Good for swimming and snorkeling. Could inflate orally when tired and then deflate (2)
- Inflated 5 times in water, feel more safe and secure (1)
- Inflates rapidly (2)
- Nothing (1)

4. (O)
- Passed all the test (4)
- Comfortable after wearing all day (2)
- Was unable to turn face down when inflated (2)
- Good inflation (1)
- More compact and therefore it can be stored in a more readily available place. Will not clutter up in the helm area (1)

5. (A)
- Tried device in extremely heavy surf. Was impressed with ability to keep to stern with minimum of effort (1)

5. (A) (cont.)
   - People seeing the device remarked about its features and indicated they would be more inclined to wear it over standard types (1)
   - CO2 inflator (1)
   - Needed to use oral inflator after manual malfunction (1)

6. (C)
   - Wore it all the time and was comfortable (3)
   - None (2)
   - Easy to inflate or deflate in short time by either manual (CO2) or oral (1)
   - Not as bulky as Type I when inflated (1)
   - I'm a large women and can at least move in this one (1)

7. (Q)
   - Automatic inflation (1)
   - None (1)

8. (M)
   - Automatic inflation (4)
   - During tests, inflation response was immediate and oral inflation was simple (2)
   - Performed well in tests (1)
   - Neat, well made, automatic inflation worked well, but see no reason to pay extra for this (1)

9. (N)
   - None (3)
   - Oral inflator simple and easy to use (2)
   - Never before had anyone asked to use a lifejacket (1)

10. (F)
    - None (4)
    - Swimming with it on and playing with it, I liked it (1)
    - Guests found it easy to understand how to use the device and appeared to react favorably (1)
    - Holds you high in water (1)
    - Oral inflation (1)
    - Jumped into deep water and pulled ripcord while head was 6 feet under. PFD brought me up promptly without shocking or discomforting jerks (1)

11. (G)
    - I automatically wear it and I seldom wore normal PFD's (1)
    - Quick to inflate and good head support (1)
    - Was able to remove device quickly and inflate manually and throw to water skier (1)
    - None (2)

12. (E)
- Does not interfere with work on boat (3)
- First time I could wear a PFD in hot weather comfortably (2)
- Readily acceptable to mothers and children. They could not roll over in the water face down (1)
- To have it on under a coat (1)
- Could wear device for ten hours straight without being aware that I had a PFD on (1)
- Brought me up to the surface without a jerk (1)
- None (1)
- Inflated everytime (1)
- Night time use (1)
- Wore PFD more often this summer (1)

13. (V)
- I hit the water and pulled the cord. I came up and was floating in seconds (2)
- None (1)
- Could not put my face down in water (1)
- No discomfort after 4 hours of wear (1)

14. (W)
- Inflated quickly after hitting water and head was held up high (2)
- Device inflated and brought me to the surface before my normal reactions made me think of pulling the pull cord (1)

II VESTS

1. (I)
- Flotation is good (4)
- Inflates quickly (4)
- Comfortable (3)
- Freedom of movement (2)
- Two large air chambers, one will support average person (1)
- More support then inherently buoyant PFD (1)
- Keeps head and most upper part of body out of water (1)
- Ease of donning (1)
- Cannot remain face down (1)
- Cooler (1)
- None (1)

2. (J)
- Warmth and comfort (9)
- Ease of donning (5)
- Equal support to standard PFD (2)
- Good righting characteristic (3)
- More desirable then the standard type III PFD (1)
- Kept head out of water better than regular PFD (2)
- Was able to swim freely in water when fully inflated (1)
- Have complete faith in fast water (1)
- None (2)
- Freedom of movement (2)
- Can swim down and away from obstruction then inflate (1)
- Don't become overheated (1)

III BELTS

1. (L)
   - Small and compact (3)
   - Cool in summer (2)
   - Freedom of movement when swimming (1)
   - None, very poor (2)
   - Quick inflation (1)

2. (R)
   - None (3)
   - Device works equally well for both adults and children over age 8 (1)
   - Device made me feel secure in test (1)

3. (K)
   - None (3)
   - Forgot I had it on (3)
   - Used it as a work vest and it allowed more freedom of movement (1)

IV JACKET

1. (U)
   - My wife is non-swimmer but was able to put on hers and inflate while she was in the water. The standard PFD can be donned in water by experienced person but is poorly done by the inexperienced. The concept of putting on a jacket and zipping up is known by everyone. (1)

V Automatic Inflator (P)
- None (1)
- It inflated slowly (so as to not startle the wearer) (1)
- Did not impede motion on SAR mission (1)
- Worked perfectly in simulated emergency (1)
- Stood up well under extreme heat of direct sunlight (1)
- Non-swimmers aboard are not as reluctant to wear it as they are standard PFD's (1)

VI HYBRIDS

1. (S)
   - None (1)

2. (T)
   - None (2)

FURTHER COMMENTS

I YOKES

1. (B)
   - Will not buy at any price (1)
   - I wear PFD's only in dangerous situations (1)
   - Average boater doesn't maintain standard PFD's very well (1)
   - Strap system hard to adjust in water. Poor strap closures and adjustments (1)

1. (B) (cont'd)
   - CO_2 cylinder filled bladder only 50% (1)
   - You would have to don several times to know how to put it on quickly (1)
   - Of all device tested by Auxiliary only heard of one respondent that held air for a long period. Hard to let air out after repacking (1)

2. (D)
   - Needs to be made bigger to fit over head. If body straps are tootight, the device, when inflated will choke (2)
   - If properly dried and stored, device could last many seasons (1)
   - Hard to replace in pack (1)
   - Respondent believes they should be approved. Carries a throwable anyway and it seems reasonable that boaters should have the option of a compact inflatable. If divers can depend on inflatables boaters should be able to as well (1)
   - Metal snap hook should be non-corrosive. Should be made easier to repack (1)
   - Inflatables should be recommended (1)
   - Freedom of movement combined with safety would encourage public (1)
   - The enclosing cover should be made of lighter material (1)
   - Very buoyant (1)
   - Would help to have written instructions on using inflation devices (1)
   - Cannot remove device without deflating (1)
   - Outer cover is very rough on neck; starts to deflate in less than 5 hours (1)
   - The belt is expensive (1)
   - Too much air leakage (3)
   - Very durable material but caused chafing, pull balls got in the way of controls when leaning. Device was 50% full after 12 hours (1)
   - Velcro around cylinder needs lots of pressure (1)
   - Should be sold by neck size (1)

3. (H)
   - Why not inflatables used on aircrafts? Appear more comfortable (1)
   - Used it when there seemed to be chance of falling overboard (1)
   - An excellent device that would last a long time (1)
   - Well engineered (1)
   - Belt should be longer; buckle hard to undo (1)
   - Dries quickly (1)
   - Found no snag problems during test as sailing crew member. Hard to operate waist band clasp. The mouth-inflation tube and gas cylinder retaining flap were too loose. Tube did fall out during sailing (1)
   - Unthinking person may inflate device "for fun". Therefore there should be a regulation to have at least two spare cartridges on board (1)
   - Air leaked around cartridge. When orally inflated or when CO_2 cylinder was removed, the PFD would stay inflated for days (1)

4. (O)
   - Need adequate supply of cartridge (1)
   - This PFD is very serviceable with good flotation (1)
   - This device should be approved (1)
   - Prefer the reliability of inherently buoyant devices (1)
   - Would still have problem of getting the public to wear inflatables. They are easy to stow (1)
   - Hard to locate loop to tie straps - simple tie may result in no tie at all. Maybe buckle or strap is safer here (1)
   - Wearing instructions OK, but could be put on backwards, especially by a child (1)
   - Retrieval strap should be attached to the back of neck (1)
   - Instructions say "check gas charge". I do not have scale to weigh them (1)

5. (A)
   - Will not float off a vessel after sinking (1)
   - More people would wear inflatables than inherently buoyant PFD's (1)
   - The only fault seems to be accessability and attachment of the CO2 cylinder to the trigger device. Otherwise device is well made (1)

6. (C)
   - Should be warning on device to treat with great care (1)
   - This is only device I have worn constantly (1)
   - Needs fire orange color (1)
   - Most comfortable device I have ever worn (1)

7. (Q)
   - Have questions as to long term serviceability of these inflatable PFD's if they don't receive regular and frequent inspection/service. The Air Force Life Support Equipment Technicians who inspect and repair LSE are fully trained and supervised to insure applicable Tech orders are complied with. Some expensive repair items (such as glue) for repairing LSE have short shelf life after having once been open. Will they be willing to use the best (and most expensive) materials (even with short shelf life) or will they cut corners with someone's PFD (1)

8. (M)
   - The PFD did not inadvertently inflate in 20 minutes of a heavy shower exposure (1)
   - PFD was inflated 72 hours with no noticable loss of inflation (1)
   - Subject jumped overboard and resurfaced in 4.5 seconds. Had good turning moment (1)
   - Small person could be uncomfortable since device comes in only one size (1)
   - Zipper closure is no good in water (1)
   - Needs anti-corrosion material in threads (1)
   - All inflatables should be automatic (1)
   - PFD did not automatically inflate in rainy weather (1)
   - Does not keep head sufficiently out of the water. Easy to turn face down (1)

9. (N)
   - If worn in the belt mode, would be useless in anything but calm seas (1)
   - Left PFD inflated for 30 days and was still usable without more inflation (1)
   - Trigger very hard to reset but eventually learned to do it (1)
   - May stow device in difficult place to retrieve in case of emergency (1)
   - Should have neck retrieval strap (1)
   - Place trigger device on outside (1)

10. (F)
   - Difficult to repack (2)
   - Lost zipper closure (2)
   - I liked PFD (1)
   - Once used would a person reset or recheck the device (1)
   - The belt attachment method could be improved. The belt had to be knotted to retain it (1)
   - Need a PFD ready to do its job, not an inflatable (1)

11. (G)
   - Difficult to repack (2)
   - I don't believe this device is ready for the boating public. It's too confusing to completely don and then repack (1)
   - Device is very serviceable, quick inflating and has great flotation once you get it on (1)
   - Device was terrible - CO2 cylinder, the oral inflator and whistle kept getting in the way (1)
   - It was hot in the sun (1)
   - It was impossible to swim while wearing it. There was too much inflation in one spot (1)
   - If partially inflated, I was afraid to pull cord for fear of popping the seams (1)
   - Slight leakage over 48 hours (1)
   - When lanyard was not pulled hard, the vest inflated only about 75-85% (1)

12. (E)
   - Would people remember to buy new cartridges to replace used ones (2)
   - Very comfortable to swim in 48 degree Bay waters (1)
   - Wore device in 52 to 102 degree F. and it was always very comfortable. It is unrestricting even when worn over foul weather gear (1)
   - Very little leakage after 72 hours of inflation (1)
   - I don't think any operator/user inflated PFD can be considered sufficiently reliable to be a life saving device (1)
   - User must wear device. That would keep it out of bilge, etc (1)
   - No way would I trust a child in an inflatable such as this one (1)
   - I feel this device would give the wearer a false sense of security. Safety first, appearance and comfort later (1)
   - Device easier to wear and use but too expensive (1)

12. (E) (cont.)
- No matter what type of device, many people would use them only in special cases (1)
- Wearing PFD's that are comfortable might influence other boaters (1)
- I like the device for comfort and storage but have several cons: 1) user must be instructed in inflation techniques, 2) malfunction of activating device if lever improperly positioned, 3) lever had place for safety pin butnone was provided (mixed feeling about pin - without it PFD could accidently inflate - without removing the pin it would not be inflated), 4) PFD loses some pressure, 5) cost of CO2 cylinders, 6) uncomfortable when fully inflated, 7) less hypothermia protection in comparison to Type III vests, 8) flame resistance? (1)
- Difficult having boater inflate all his PFD's for inspection (1)
- Children would be inclined to pull cord just to test (1)
- CO2 would rust or not work properly if not rinsed in fresh water which I did after use (1)
- Cylinder would start to rust if left in very long. Materials would not stand rough treatment (1)

13. (V)
- After owning boats for nine years I see the lack of concern boaters have for normal PFD's. Do not feel boaters would take the time to replace used cartridges (1)
- Kids like it better than kapok PFD (1)
- Inflatables are more comfortable to wear (1)

14. (W)
- The availability and standardization of inflatable CO2 cylinders (1)
- One spare cylinder should be carried on boat at all times (1)

II VESTS

1. (I)
- Would buy device despite short comings (1)
- Device is excellent (1)
- Mass production may bring cost down to regular type II or III (1)
- May be more wearable than type II or III (1)
- Location of oral inflation tubes keeps air in bladder despite leakage over period of time (1)
- Needs automatic inflation (1)
- Feel safer with dual system (1)
- Unit stayed fully pressured for only about 6 hours (1)
- Wouldn't recommend it on a small sailboat (1)
- Wouldn't recommend it on a small sailboat, could get knocked out and fail to pull cord (1)
- People forget to replace cylinders (1)
- Don't like reliability (1)
- I think that if inflatables are approved there must be qualified and approved individuals/organizations (similiar to PAA Parachute Riggers/Coats) for servicing and repairing the PFD. I think that

1. (I)(Cont.)
the inflation system needs to be "sealed" to certify inspection and full cylinders and that at least yearly inspections are mandatory (including bladder 24 hour pressure checks) similiar to present military inflatables.

If a boarding party wishes to function inflatable it raises the problem of leaving the owner with a PFD that will cost him money to put back into service and that will not meet its intended use (a compact unobtrusive PFD) and is more prone to damage since bladders would then be inflated and unprotected (1)

2. (J)
- I liked it very much (7)
- Should not be approved for small children because of manual inflator (2)
- Like pockets (2)
- Should fit more snuggly to prevent ride up. Could use method to attach device to belt of wearer (3)
- Pockets should have drains (1)
- Should have permanent flotation (1)
- Manual inflator should be made more simple. Person had problems puncturing cylinder (1)
- Material should be non-flammable to prevent burn holes (1)
- Would like stronger strap around vest with rings to attach to safety line (1)
- Zipper should be stronger and made of nylon (2)
- Didn't leak air but requires good maintenance (1)
- The literature should include that device be inflated manually so that the user will be familiar with opening and closing valve (1)
- Need readily available cylinders, oral inflation is awkward (1)
- Cylinders punctured to do additional tests were either empty or the neck so thick that the point that punctures a hole didn't. Therefore, vest did not inflate (1)
- Device was treated roughly on over 20 safety patrols and still works well (1)
- Material doesn't breath. Inspector should use air pump, not device owner's cylinders (1)

III BELTS

1. (L)
- Would not buy device at any price (3)
- Whistles are good (1)
- Add two leg straps to prevent ride up (1)
- Add plastic tag to cylinder to show last date of boat operator cylinder inspection. Similar to fire extinguisher check tag (1)
- Not suitable for ordinary people. Cannot depend on cylinder maintenance (1)
- Price and availability of CO2 cylinder is a factor (1)
- Good for recreational boats but it could get into machinery on work boats (1)
- Should not be approved because it does not provide proper flotation (1)
- Would not use with present set of instruction unless last resort (1)

2. (R)
   - Should concentrate on improving trigger mechanism, adjustable belt size and repacking (2)
   - Should be recommended only as extra PFD (1)
   - This device is only good for a person who is conscious and not afraid of water. Son, age 10, could not squeeze trigger due to hand span (1)
   - Very difficult to recharge or replace cylinder and once it was not seated firmly due to cross threading (1)
   - This belt type device is far superior in convenience to some yokes (1)
   - Unless the cap is on tight, the air will leak out. Sometimes it' hard to determine when the cap is tight or not without trying it out (1)

3. (K)
   - Performed satisfactorily but prefer inherently buoyant device (1)
   - Reliability is a problem (1)
   - Needs automatic inflation (1)
   - PFD was comfortable and fashionable enough to wear all the time while boating. I plan to buy one. It also worked well in the water (1)
   - Device is not as safe in rough or cold water as regular PFD's (1)
   - Would not give to children (1)

IV JACKET

1. (U)
   - Inflating and deflating the PFD while in the water diving and snorkling can and does get water in the bag which can only be emptied out of the water (1)

V Automatic Inflator (P)
- Human error is a problem but still recommend approval (1)
- Cost more than Type II PFD's (1)
- Cylinders difficult to obtain (1)
- Can be inflated accidently (1)
- Not like inherently buoyant device where no maintenance is ever needed. Average boater would not take the time to do it properly (1)
- I believe only manufacturer of PFD should be required to produce at at least one model that does not have zippers (1)

VI HYBRIDS

1. (S)
   - None (1)

2. (T)
   - Not much better then approved devices (1)

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INFLATABLE PERSONAL FLOTATION DEVICE STUDY.(U)
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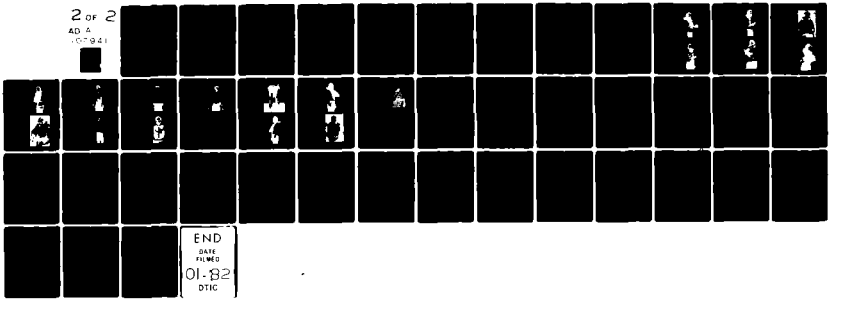

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Comments by Mr. Fred Harris, a professional yacht racer and Auxiliarist with a strong interest in and experience with inflatables, believes the following should be required of inflatables:

- Self-inflation
- Oral inflation
- Manual inflation
- Waist strap must be attached and the importance of it being fastened correctly should be stressed by the Coast Guard.
- Neck strap for retrieval purposes should be provided.
- A non-return valve should be installed in all oral inflation devices.
- Each vest should have a strap in the front of it so that a man can place both hands under the strap. This would relax the man in the water and help prevent hypothermia.
- Instructions on how to wear the PFD, not just how to reload, should be printed.
- All whistles attached to PFD should be tested in the water first.
- All inflatable PFDs should be dusted with powder after use and before storage.
- If a harness cannot be worn with an inflatable PFD it should be so stated and this statement should be made visible on the jacket before the purchaser buys.
- All oral inflation devices should be easily visible to the wearer.
- Each vest should contain a water activated light.
- All PFDs should have an air escape valve similar to DIV II. This would allow the wearer to dry the inside of the vest and allow him to put powder inside the vest.
- The manufacturer should be required to provide a repair kit for each vest they make.
- Personally, I feel that a vest should not be sold unless a harness could be worn safely with it.
- Instruction book and/or PFD should state that a used CO_2 cartridge should be immediately removed and thrown away so as to assure that there is either no CO_2 cartridge in vest or one that has not been used. Lastly, I believe the Coast Guard should stress that in purchasing a PFD of this nature it is important that the user be made aware that the device fits the body correctly.

ANALYSIS AND CONCLUSION

The results of the CG Auxiliary inflatable PFD study can be analyzed using four subject areas. See Appendix F for definition of terms. They are:

1. Reliability/Maintenance/Serviceability
2. Wearability
3. Accessibility
4. Physical Effectiveness

In order to distinguish between the questionnaire sources of particular questions which are referenced in these conclusions, the question itself will be followed by its source, either (Q) for quarterly or (F) for final, and the number in parentheses. Since there is parallel numbering in the quarterly questionnaire, an asterisk will be placed beside the number to denote the second set of questions in the quarterly numbered 1 thru 13.

Reliability/Maintenance/Serviceability

One main purpose of this study was to determine the field reliability of the devices. To this point we mainly had design reliability data. The following analysis pertains to field reliability.

Of the final questionnaires returned, for inflatables as a whole, 16.3% showed a positive response to the question, "Did you ever go to use this device when you thought it was operable only to find it was not?" (F 1.a) For the general population of inflatable users, the number of times their devices would not be operable in the manual or automatic inflation modes sometime during the boating season would be between 12.5% and 20.1%. Only the design of N registered significantly below the mean response for all inflatable designs. These are immediate failures including such events as non-puncture of cylinder, forgetting to change spent cartridge, inflation mechanism not recocked, and oral inflator

locked in deflation mode. Many of these mechanical failures could be countered by oral inflation. This assumes that wearer would be physically and mentally capable of finding or correcting the problem following entry in water without expected inflation. Some respondents stated that they used oral inflators but they were not specifically asked to comment.

Three factors may effect these results: one, Auxiliarists tend to be more safety conscious than the average boater; two, each Auxiliarist was asked to conduct a brief familiarization exercise before general use; and three, each Auxiliarist was asked his or her opinions and other personal information relating to usage of the inflatable PFD. These three factors, high safety consciousness, familiarization with the PFD and personal attention by the Coast Guard tend to increase PFD field reliability due to added attention to the condition and usage of the inflatable PFD by the study participant.

When asked the question, "In a genuine boating emergency, I'd want to be wearing or using a PFD of this type" (Q6*) the inherently buoyant device scored significantly higher than the mean of all the PFD responses and also individual brand mean responses. In another question, "Do you trust the device to perform adequately if called upon in an emergency?" (F 7.a) only 64% of all users answered affirmatively, with one design M, receiving significantly more favorable response than the mean response and another design L significantly below the mean. In another question relating to trust, "If you had guests aboard who were not familiar with boats which type of device would you be more likely to show them how to use?" (F 6) only 25% favored their test PFD over their customary PFD. The M, E, J, and H designs had significantly higher favorable responses than the overall mean, while the L design was significantly worse than the mean. Finally for the question, "How would you compare the reliability of the inflatable with your CG approved PFD? 3-more reliable; 2-the same;

1-less reliable." (Q11), the mean response for all response for all inflatables was 1.54. With repeated tests, 68% of the brand or model means would fall between 1.38 and 1.70.

One reason for concern about design and field reliability was leakage of the inflation medium. To ascertain the extent of this problem, the questions was asked, "Was the PFD still firm after 24 hours?" (Q2). The mean for all inflatable PFD's was 65% "Yes." The bladders of designs I and D were significantly more prone to leakage than the mean for all inflatables. Design J held the inflation medium significantly better. From this data it can be interpreted that there are many Auxiliarists with the feeling that inflatables are less reliable than inherently buoyant devices. When looking at the percentage of times that the device was not operable in the automatic or manual inflation modes, at sometime during the boating season, this feeling is backed with fact.

Maintenance/Serviceability

When asked the question, "If not carefully maintained and checked, this PFD might deteriorate quickly to the point where it would malfunction," (Q5*) inflatables, except for design E, did significantly poorer than the inherently buoyant device composite. Inflatables, in the Auxiliarists' opinions require more care. The responses to the question, "Did you encounter problems restoring the PFD's to a serviceable condition?" (Q4) varied greatly according to brand or model (0% to 61%). 28% of all respondents had problems. The designs of brands I and F had significantly more problems while J and H has significantly less. Many of the serviceability problems centered around repacking of the bladder inside a case. Other problems included difficulty in replacing CO2 cylinders and problems with zipper corrosion.

When asked whether the Coast Guard should require a qualified service facility to restore the device to serviceable condition (Q5), the brand with

the most favorable average response was 50% favorable and other designs showed a progressively less favorable response. 24% of all respondents favored this idea while those respondents who tested brands J and K were significantly less in agreement. Questioned whether they would be willing to pay for a servicing facility to inspect the device (F 9.a.) only 32% of all respondents were affirmative. There was no significant difference between brand responses and the mean for all inflatables.

Most Auxiliarists questioned are not in favor of a required qualified service facility inspection option or are not willing to pay for such a facility. The other major option would be to have the average boater perform serviceability checks, such as visually and manually checking bladder for leaks and inflation mechanism for charge. According to the data, one half of the Auxiliarists believe that the average boater can do an adequate job of inspection (Q6.c.). The percentage by brand ranged from 22% to 75% with the I design significantly lower than the mean. If repairs were necessary 54% would do it themselves and the rest would have a service facility do them (F 9.b.). There was a great variability according to brands ranging from 89% to 27%. Design G was significantly above and I significantly below the mean. When asked whether the test device was in good enough condition to last another boating season 92% of the Auxiliarists said "Yes" (F 8.). There was no significant difference between any inflatable design and the mean. But designs H, B, P, M, A and O apparently were in significantly better condition then the designs F, N, E and I.

Wearability

The inflatable PFDs in this study are as a group and individually not as hot or sweaty in warm weather as the inherently buoyant devices (Q7*). Design K does significantly better than all other designs in this regard.

With the exception of designs I and G all the inflatables are significantly less restrictive to body motion and get in the way less (Q4*). Also as a group inflatables are more attractive than inherently buoyant devices, although 9 out of 12 individual designs show no significant difference with the composite device. K, E, J and H are more attractive. There are three designs of inflatables, D, F and I which rub, scrape or pinch the wearer significantly more than the composite inherently buoyant device (Q13*). One inflatable model, K, rubs significantly less. Also, the inherently buoyant PFD, with the exception of J, tends to keep the wearer just as dry or drier in rain or spray (Q3*).

The following question, asked at the end of the boating season, bears heavily upon wearability: "Would you wear a device like the test PFD more often than you would your present approved PFD?" (F 4). 5-much more; 4-somewhat more; 3-same; 2-somewhat less; and 1-much less. There are four brands, M, J, E and H which score significantly higher than 3. These four scores range from 3.5 to 4.0 which means that they would be worn slightly to moderately more than the inherently buoyant composite. The mean response rate for all inflatables was 3.15 which indicates that the respondents would wear most inflatable devices no more than their inherently buoyant devices.

One reason for no significant difference in the mean wear rates between most inflatables and inherently buoyant devices appears to be the result of a trade-off between increased comfort versus the fears of decreased reliability of the inflatable. Even if people find an inflatable PFD more comfortable and attractive to wear they tend to be wary of a device if they don't trust it to save their lives. This is logical since the reason they would bother to wear the device in the first place is to be saved in an emergency. The idea behind inflatables, when compared with inherently buoyant devices, is to improve wearability to at least compensate for its inherently less reliable design. According to the results of this study, most inflatables are not worn more often.

Of those that are, the increase in wearability is slight to moderate. As was stated previously in the introduction, some of the inflatables were compared to inherently buoyant Types I or II which are not as wearable as Type III. A second reason may be that the boating public is nearing the saturation point in terms of the wearability of any PFD. There seems to be a certain percentage of boaters who are not going to wear PFD's no matter how wearable they are. So even if inflatables were more wearable it may make little or no difference in terms of lives saved.

One possible solution to this problem would be to have the Coast Guard approve the inflatable as meeting the carriage requirements only when worn. The Auxiliarists were asked if they would buy their test device if it was approved only when worn (F 2.b.). This question was posed in light of the Auxiliary paying only the amount that they stated they would pay if the device had standard approval. Only 35% would purchase the inflatable under that kind of approval program. Design H scored a significantly more favorable response than the mean response for all inflatables.

Accessibility

The inherently buoyant device composite received significantly more favorable responses than inflatable PFD's as a whole in three questions related to accessibility. The first question asked whether the test PFD "can be conveniently used as a cushion or pillow to sit or recline on" (Q1*). Only one design, F showed no significant difference when compared to the inherently buoyant device. The other brands scored well below. Both types of devices (inherently buoyant and inflatable) received negative ratings for this use, ranging from slightly disagree to strongly disagree. The response tends to show that inherently buoyant devices may be more accessible if used as a cushion while boating instead of in storage, where it may become lost, particularly if it is a small size.

The second question inquired if the respondent had the test inflatable aboard his or her boat, he or she would "keep it out in the open so it would be accessible in case of an emergency" (Q2*). The inherently buoyant composite scored significantly above the inflatable mean response though both types of devices earned favorable responses. Designs K, G and L were significantly below the inherently buoyant device composite and design A.

The responses to the statement, "This PFD is useful for my boating activities in addition to providing flotation in the event of an accident" (Q8*) were mixed. One design, J, scored significantly above the inherently buoyant device. This device had pockets, a feature which was received most favorably by those Auxiliarists who used this design. Several designs, I, D, L and G scored significantly below the inherently buoyant device composite with design G, the lowest, scoring a "disagree moderately" average response.

Physical Effectiveness

A numerical analysis of this area was not done except for donning. The components of physical effectiveness in the water - turning moment, body and head angle, chin support and visibility forward and from side to side can be measured carefully by the Coast Guard utilizing test subjects. The Coast Guard has done tests which show that a proper level of physical effectiveness can be obtained with inflatables (not necessarily those used in this study). Comments concerning this by study participants can be found in both questionnaires, particularly question 10 in the quarterly questionnaire.

As far as donning is concerned, there were two distinct significantly different groups of inflatables when Auxiliarists were asked to compare their inflatable test devices with their CG approved inherently buoyant devices (Q8). Designs I, E, C, J, H and L were deemed somewhat easier to don while the designs

D, B, A, G, I and F were somewhat more difficult. The first group consisted of the two belt styles, a vest and three of the eight yokes analyzed in the quarterly questionnaire. The second group was composed of the rest of the yokes and a vest. At least a couple of these devices had problems with the size of the head openings.

APPENDIX A - PICTURES AND DESCRIPTIONS OF TEST INFLATABLE PFD'S

INFLATABLE PFD DATA SHEET

Brand/Model : O

Brand/Model : A

DESCRIPTION: Yoke type inflatable PFD fitted with manual CO2 and oral inflation system folded into a collar. Squeeze type inflation on A

BUOYANCY: 35 lbs. ESTIMATED COST: $29.00 & $25.00

FREEBOARD: 3" TURNING MOMENT: 4 sec

OPERATING TEMPERATURE RANGE: -10°C to +60°C

EQUIVALENT PERFORMANCE TYPE: I

INFLATABLE PFD DATA SHEET

Brand/Model : B

DESCRIPTION: Yoke/Lie type inflatable PFD fitted with a manual CO2 and oral inflation system folded into a collar. Two tubes in front, divided down the middle.

BUOYANCY: 35 lbs. ESTIMATED COST: $40.00

FREEBOARD: _____ TURNING MOMENT: _____

OPERATING TEMPERATURE RANGE: -10°C to +60°C

EQUIVALENT PERFORMANCE TYPE: I

INFLATABLE PFD DATA SHEET

Brand/Model : Q

Brand/Model : P

Brand/Model : C

DESCRIPTION: Inflatable yoke/bit type PFD with automatic and/or manual and oral inflation system packed into a collar. 5 sec. inflation time with automatic.

BUOYANCY: 22 lbs. (BSIQ) ESTIMATED COST: $43,98 $81.50 & $47.86

FREEBOARD: 3" TURNING MOMENT: 3-5 seconds

OPERATING TEMPERATURE RANGE: -25°C to +60°C

EQUIVALENT PERFORMANCE TYPE: I

INFLATABLE PFD DATA SHEET

Brand/Model : P

DESCRIPTION: Dual chambered inflatable yoke fitted with manual CO2 and oral inflation systems.

BUOYANCY: 35 lbs. ESTIMATED COST: $40.00

FREESBOARD: 4" TURNING MOMENT: Excellent 1 - 2 seconds

OPERATING TEMPERATURE RANGE: -10°C to +60°C

EQUIVALENT PERFORMANCE TYPE: I

Yoke is similar to vest (I) except that it does not have mesh vest material.

INFLATABLE PFD DATA SHEET

Brand/Model : E

DESCRIPTION: Inflatable yoke with manual CO2 and oral inflation system

BUOYANCY: 20 lbs. ESTIMATED COST: $30.00

FREEBOARD: 3½" TURNING MOMENT: Good

OPERATING TEMPERATURE RANGE:

EQUIVALENT PERFORMANCE TYPE: II

INFLATABLE PFD DATA SHEET

Brand/Model : F

Brand/Model : G

DESCRIPTION: Yoke type inflatable PFD fitted with manual CO2 and oral inflation systems and packed in a collar (F) and a pouch (G).

BUOYANCY: 35 lbs. ESTIMATED COST: $37.50

FREEBOARD: 3½" TURNING MOMENT: Excellent 1 sec.

OPERATING TEMPERATURE RANGE: -10°C to +70°C

EQUIVALENT PERFORMANCE TYPE: I

INFLATABLE PFD DATA SHEET

Brand Model H

DESCRIPTION: Inflatable yoke fitted with manual CO2 and oral inflation system

BUOYANCY: 21 lbs. ESTIMATED COST: $30.00

FREEBOARD: _____ TURNING MOMENT: Good

OPERATING TEMPERATURE RANGE: _____

EQUIVALENT PERFORMANCE TYPE: II

INFLATABLE PFD DATA SHEET

Brand/Model I

DESCRIPTION: Dual chambered inflatable vest fitted with manual CO2 and oral inflation systems.

BUOYANCY: 35 lbs. ESTIMATED COST: $40.00

FREEBOARD: 4" TURNING MOMENT: Excellent 1 - 2 seconds

OPERATING TEMPERATURE RANGE: -10°C to +60°C

EQUIVALENT PERFORMANCE TYPE: I

INFLATABLE PFD DATA SHEET

Brand/Model : J

DESCRIPTION: Inflatable vest with manual CO2 and oral inflation system.

BUOYANCY: 22 lbs. ESTIMATED COST: $50.00

FREEBOARD: 21" TURNING MOMENT: Good (4 seconds)

OPERATING TEMPERATURE RANGE:

EQUIVALENT PERFORMANCE TYPE: II

INFLATABLE PFD DATA SHEET

Brand/Model : K

DESCRIPTION: Inflatable belt with squeeze-type manual CO2 and oral inflation system packed in a cloth belt or pack.

BUOYANCY: 18 lbs. ESTIMATED COST: $25.00

FREEBOARD: 3" TURNING MOMENT None

OPERATING TEMPERATURE RANGE:

EQUIVALENT PERFORMANCE TYPE: No equivalent

INFLATABLE PFD DATA SHEET

Brand Model : L

DESCRIPTION: Belt - type inflatable PFD fitted with manual CO_2 and oral inflation system and folded into a pouch.

BUOYANCY: 11 lbs. ESTIMATED COST: $20.00

FREEBOARD: 2½" TURNING MOMENT: Fair-- will turn some people

OPERATING TEMPERATURE RANGE: _____

EQUIVALENT PERFORMANCE TYPE: None of the present types.

INFLATABLE PFD DATA SHEET

Brand Model : M

DESCRIPTION: Inflatable Litevest fitted with automatic cool gas generator and oral inflation system; generator produces 95% nitrogen and 5% hydrogen gas.

BUOYANCY: 15 lbs ESTIMATED COST: $65.00

FREEBOARD: 5½" TURNING MOMENT: Fair (7-10 sec)

OPERATING TEMPERATURE RANGE: -20°C to +40°C

EQUIVALENT PERFORMANCE TYPE: II

INFLATABLE PFD DATA SHEET

Brand/Model : N

DESCRIPTION: Yoke type inflatable PFD fitted with a squeeze type manual CO_2 and oral inflation system packed in a belt.

BUOYANCY: _____ ESTIMATED COST: $40.00

FREEBOARD: _____ TURNING MOMENT: _____

OPERATING TEMPERATURE RANGE: _____

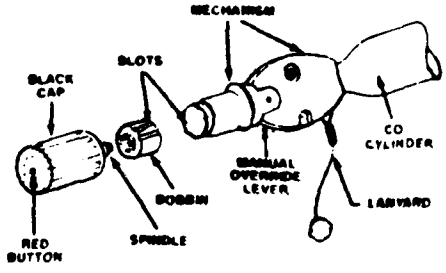
EQUIVALENT PERFORMANCE TYPE: II

INFLATABLE PFD DATA SHEET

BRAND/MODEL: P

DESCRIPTION: Automatic Inflation System

ESTIMATED COST: $4.50



INFLATABLE PFD DATA SHEET

Brand/Model : R

DESCRIPTION: Inflatable belt with squeeze-type manual CO_2 and oral inflation system packed in a cloth belt or pack.

BUOYANCY: 18 lbs. ESTIMATED COST: $25.00

FREEBOARD: 3" TURNING MOMENT: None

OPERATING TEMPERATURE RANGE: _____

EQUIVALENT PERFORMANCE TYPE: No equivalent

INFLATABLE PFD DATA SHEET

Brand/Model : S

DESCRIPTION: Yoke/bib type hybrid inflatable PFD with manual CO_2 and oral inflation system. Front of device partially filled with foam.

BUOYANCY: _____ ESTIMATED COST: _____

FREEBOARD: _____ TURNING MOMENT: _____

OPERATING TEMPERATURE RANGE: _____

EQUIVALENT PERFORMANCE TYPE: _____

Brand Model : U

INFLATABLE PFD DATA SHEET

Brand/Model : U

DESCRIPTION: Inflatable jacket with oral inflation system.

BUOYANCY: 35 lbs. ESTIMATED COST: $65.00

FREEBOARD: 4½" TURNING MOMENT: Good 4-6 sec.

OPERATING TEMPERATURE RANGE:

EQUIVALENT PERFORMANCE TYPE: I

INFLATABLE PFD DATA SHEET

Brand/Model : W

DESCRIPTION: Inflatable yoke/bib fitted with automatic and manual CO2 and oral inflation system. Automatic inflation time less than 5 seconds.

BUOYANCY: 35 lbs. ESTIMATED COST: $105.00

FREEBOARD: 3½" TURNING MOMENT: 3-4 seconds

OPERATING TEMPERATURE RANGE:

EQUIVALENT PERFORMANCE TYPE: 1

APPENDIX B - INITIAL LETTER AND QUESTIONNAIRE
TO C.G. AUXILIARY STUDY PARTICIPANTS

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS: (G-MMT-3/TP23)
U S COAST GUARD
WASHINGTON D C 20590
PHONE 202-426-1444

16714/160.001/INFLATABLES
1 July 1979

Dear Auxiliarist:

You have been selected by your Director of Auxiliary to participate in a very important Coast Guard study. The purpose of this study is to enable the Coast Guard to make a better decision on the possible approval of inflatable PFD's by providing a data base on the operational use of inflatables in a quasi-recreational boating environment.

Instructions for participants in the study, the initial questionnaire, schedule, and relevant background information on PFD's are contained in enclosure (1). An inflatable PFD, five (5) CO2 cylinders, and a manufacturer's instruction manual are also included.

Should you desire not to assist the Coast Guard in this study, please return the PFD and all related materials to the letterhead address. If you do choose to participate, please familiarize yourself with the study plan and proceed as directed by the plan. Note that the initial questionnaire attached to the study plan should be completed and mailed back to the Coast Guard immediately. Additional questionnaires will be mailed later for you to complete after performing the monthly tasks outlined in the study plan. This is a four (4) month study and will terminate approximately 1 November 1979.

I wish to emphasize that in order for the results of this study to have any merit, answers to the questionnaires must be straightforward. Equal consideration will be given to both positive and negative opinions so please feel free to comment openly on any question.

If you decide to participate in this project, your assistance will be of great value to the Coast Guard's Recreational Boating Safety Program. I would like to personally thank you for your continued interest in our boating safety efforts.

Sincerely,

R.E. THOMPSON
Rear Admiral, U. S. Coast Guard
Chief, Office of Boating Safety

Enclosure: (1) Inflatable PFD Study
(2) Inflatable PFD
(3) Five CO2 Cylinders
(4) Manufacturer's Instruction Manual

INFLATABLE PERSONAL FLOTATION DEVICE STUDY

A. Introduction.

For the past several years the Coast Guard has been researching the feasibility of approving inflatable PFD's. Thus far, the research indicates that an inflatable PFD can be as good or better than the presently approved inherently buoyant PFD's with respect to wearability, physical effectiveness and design reliability. The remaining principle question is whether an inflatable PFD can retain its reliability in a recreational boating environment.

Since inflatable PFD's are not USCG approved and therefore do not satisfy PFD carriage requirements, no data has been collected on their usage in recreational boating. It is the purpose of this study to obtain such data, thus enabling the Coast Guard to more effectively determine the long range reliability of inflatable PFD's.

The Coast Guard has purchased over 500 inflatable PFD's of assorted designs and means of inflation. You will be given an inflatable PFD, five extra CO_2 cylinders, and an instruction manual. You are asked to thoroughly familiarize yourself with this new PFD and treat it as your own. You are asked to perform certain tests with the new PFD and to periodically report certain information to the Coast Guard. At the end of the study, 1 November1979, you will be asked to return your PFD for testing at an independent laboratory.

B. General rules for the use of inflatable PFD's are:

1. The PFD should not be worn under clothing or any other gear.

2. The inflation mechanism should be restored to its initial ready-to-use condition immediately after use.

3. Frequent inspection of the fabric of the inflatable PFD is necessary to detect rips, tears, and other material failures.

4. A Coast Guard approved PFD must be carried on board your boat in addition to your inflatable PFD to meet Federal carriage requirements.

C. Instructions for Participants.

1. Initial checkout

a. Familiarize yourself with the inflatable PFD and its instruction manual.

b. Under controlled warm water conditions (65° F or more) test the PFD by donning and inflating it before entering the water. Lower yourself into the water or wade out until the PFD supports you. Note any initial observations. Swim around with the PFD for a few minutes to get a good feel for how it performs. Compare the performance of the inflatable PFD with that of your own CG approved PFD by performing the same tests. The following guidelines should be of help in measuring the performance of both types of PFD's:

(1) The PFD should provide sufficient buoyancy to float you with neck and head out of the water.

(2) It should not have a tendency to turn or hold you in a face-down position in the water.

(3) It should be comfortable and easy to put on and remove while allowing freedom of movement in and out of the water.

c. Restore the PFD to its original ready-to-use condition in accordance with the instruction manual. Inflate and restore the PFD again to insure that you are restoring it properly.

d. Fill out the initial questionnaire and mail it immediately.

e. Address any questions or problems to:

Commandant (G-MMT-3/83)
U. S. Coast Guard
Washington, D.C. 20590

Phone: (202) 426-1444

3. Routine usage.

a. Your inflatable PFD is to be subjected to normal activities. No special care should be taken to avoid situations which might adversely affect the serviceability of the device , since this information might indicate design characteristics which should not be allowed in USCG approved inflatable PFD's.

b. You are encouraged to use the inflation mechanism as much as possible. Five replacement cylinders are provided. When this supply has been exhausted, feel free to purchase replacement cylinders. Test-inflate your PFD with one of the replacement cylinders before actually using it. Be sure to retain one full cylinder in the inflation mechanism at all times and enough spares to complete the monthly tests.

4. Monthly tests. Every month after receipt of your inflatable PFD, perform the following tests:

a. Don the PFD. Inflate it by using the manual CO2 mechanism. In the absence of a CO2 mechanism, orally inflate and swim-test the PFD if you wish. (See initial check instructions.)

b. Leave the device inflated for 24 hours and note whether it stays inflated and firm.

c. Restore the device to the ready-to-use condition.

d. If the PFD becomes unserviceable before all of the monthly tests can be completed, return the PFD using the mailing label attached.

5. Final questionnaire. At the end of the study you will receive a final questionnaire. Complete and return the final questionnaire with the inflatable PFD using the mailing label attached.

Inflatable PFD Study
Initial Questionnaire

Organization: (check one) ☐ USCG ☐ USCGR ☐ USCG Auxiliary

USCG Test number of Inflatable PFD _____

Location(s) of Use ((city, state) or bodies of water)_____
_____

Your physical characteristics:
Sex: ☐ M ☐ F Height_____ Weight_____

Type of Boat_____

Length of Boat_____

Activities engaged in_____

Water type: ☐ Fresh ☐ Salt ☐ Both

Percentage of time in fresh water_____

Percentage of time in salt water_____

PFD(s) currently used on boat outings:	Type	Manufacturer	Coast Guard Appr. No.
	____	_____	_____
	____	_____	_____
	____	_____	_____

How often do you personally wear a PFD on boat outings?
(Please check one alternative below)

☐ I wear a PFD almost continuously (over 75% of the time)
☐ I wear a PFD most (50 - 75%) of the time
☐ I wear a PFD only part (10 - 50%) of the time
☐ I wear a PFD only a small fraction (1 - 10%) of the time
☐ I almost never wear a PFD

As a result of the *initial checkout of the PFD*, answer the following:

1. If you had not read the instructions could you have figured out how to use the inflatable PFD? ☐ Yes ☐ No
   If no, why?

2. Do you normally read instructions? ☐ Yes ☐ No

3. Were the instructions clear and easily understood? ☐ Yes ☐ No
   If no, why?

4. Did the PFD inflate properly? ☐ Yes ☐ No
If not, could you determine the cause? ☐ Yes ☐ No
If so, what was the cause?_____

_____

5. Were you satisfied with the in-water performance of the PFD?
☐ Yes ☐ No
If no, why?

6. Is it obvious how to operate this PFD? ☐ Yes ☐ No
If no, explain._____

_____

7. Do you have any questions before you continue the study?
☐ Yes ☐ No
If so, what?_____

_____

Below you see a list of statements about PFD's and related matters. Please read each statement carefully. Check one of the columns to the right to indicate how strongly you agree or disagree with the statement. Please answer every item.

	Disagree Strongly	Disagree Moderately	Disagree Slightly	Agree Slightly	Agree Moderately	Agree Strongly
1. I always keep a PFD out in the open aboard my boat so it will be accessible in case of emergency.	___	___	___	___	___	___
2. I sometimes don a PFD when I see rough water or a storm approaching while out boating	___	___	___	___	___	___
3. Most PFD's will keep the wearer's mouth and nose clear of the water if he becomes unconscious while in the water	___	___	___	___	___	___
4. If I were thrown into the water in a boating accident, I would need some help to stay afloat.	___	___	___	___	___	___
5. A responsible boater is more likely to wear a PFD than is the careless boater	___	___	___	___	___	___

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DEPT. OF TRANSP., USCG, CGHQ-5176 (9-78)

	Disagree Strongly	Disagree Moderately	Disagree Slightly	Agree Slightly	Agree Moderately	Agr Strongly
6. In a genuine boating emergency, I'd want to be wearing a PFD.	____	____	____	____	____	____
7. Adventurous boaters wouldn't wear a PFD.	____	____	____	____	____	____
8. If not carefully maintained and checked, PFD's may deteriorate quickly to the point where they would malfunction.	____	____	____	____	____	____
9. If passengers saw PFD's lying around a boat, they would probably feel safer	____	____	____	____	____	____
10. Relaxed, casual boaters would wear a PFD.	____	____	____	____	____	____
11. A PFD makes the wearer look tense and uncomfortable.	____	____	____	____	____	____
12. I make sure the PFD's are readily accessible when I encounter rough water or see an approaching storm.	____	____	____	____	____	____
13. Most PFD's are not effective in rough water.	____	____	____	____	____	____
14. PFD's are emergency equipment only and are not meant to be worn all the time.	____	____	____	____	____	____
15. I am able to tread water or swim well enough to stay afloat for at least 10 or 15 minutes without a PFD.	____	____	____	____	____	____
16. In a genuine boating emergency, I'd be better off if I weren't wearing a PFD.	____	____	____	____	____	____

DEPT. OF TRANSP., USCG, CGHQ-5176 (9-78)

	Disagree Strongly	Disagree Moderately	Disagree Slightly	Agree Slightly	Agree Moderately	Agree Strongly
17. A good swimmer really doesn't need a PFD in a boating emergency	____	____	____	____	____	____
18. I wear a PFD most of the time while boating.	____	____	____	____	____	____
19. Boaters who wear a PFD look confident.	____	____	____	____	____	____
20. The expert boater would probably not wear a PFD under normal conditions.	____	____	____	____	____	____
21. People who wear PFD's routinely are probably fearful of the water.	____	____	____	____	____	____
22. If I kept PFD's lying out in the open aboard my boat, experienced boaters or friends would probably think I was being overcautious.	____	____	____	____	____	____
23. I feel a little afraid when I'm in a small boat far from shore.	____	____	____	____	____	____

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APPENDIX C - MID-SEASON LETTER AND QUARTERLY
QUESTIONNAIRE TO C.G. AUXILIARY STUDY PARTICIPANTS

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS
U S COAST GUARD (G-MMT-3/TP22
WASHINGTON D C 20590
PHONE (202) 426-1444

16714/160.001/INFLATABLE
4 September 1979

INFLATABLE PFD IN-USE STUDY

Dear Auxiliarist:

Enclosure (1) is the mid-term questionnaire for the inflatable PFD study. It is essential that the questionnaire be filled out promtly for your comments and criticisms to be given due consideration in this study.

Before filling out the questionnaire please perform the following tests:

a. Don the PFD. Inflate it by using the manual CO_2 mechanism. In the absence of a CO_2 mechanism, orally inflate the device. Swim test the PFD if you wish.

b. Leave the device inflated for 24 hours and note whether it stays inflated and firm.

c. Restore the device to the ready-to-use condition.

d. Now review the questionnaire completely before filling it out. Note in particular that the second half should be filled in both for the inflatable (using a √) and for your usual PFD (using an X).

Return only the questionnaire using the enclosed mailing label.

Should any questions arise please contact.

Commandant (G-MMT-3)
U.S. Coast Guard
Washington, D.C. 20590

Phone: (202) 426-1444

Inflatable PFD Study
Quarterly Questionnaire

Please complete and return the following questionnaire to Coast Guard Headquarters after completion of the quarterly tests.

USCG Test Number of inflatable PFD: _____

1. Did the PFD inflate and perform properly? ☐ YES ☐ NO

   a. If not, could you determine the cause? ☐ YES ☐ NO

   b. If so, what was the cause? _____
   _____
   _____

2. Was the PFD still firm after 24 hours? ☐ YES ☐ NO

3. After 24 hours, what fraction of the chamber was still inflated? (Check One) ☐ Full ☐ 3/4 full ☐ 1/2 full ☐ 1/4 full ☐ flat

4. Did you encounter problems restoring the PFD to a serviceable condition? ☐ YES ☐ NO

   If so, comment. _____
   _____
   _____

5. Do you think the Coast Guard should require a qualified service facility to restore the device to a serviceable condition? ☐ YES ☐ NO

   Comment. _____
   _____
   _____

6. a. How often do you think a boater or qualified service facility should check the inflatable PFD? ☐ Annually ☐ Semi-annually ☐ Quarterly ☐ Monthly ☐ Other (Specify)_____.

   b. Would you do any other checks in between the required checks you recommended above in (a)? ☐ YES ☐ NO If so, what?_____
   _____

   c. Would you expect the average boater to perform these checks? ☐ YES ☐ NO

7. How would you determine if this PFD was serviceable prior to getting underway? _____
   _____

8. How would you compare the ease of donning this PFD with your CG approved PFD? ☐ Much easier to don ☐ Easier to don ☐ About the same ☐ Harder to don ☐ Much more difficult to don

9. How would you compare the wearability of this PFD (uninflated) with your CG approved PFD?

a. The inflatable is: ☐ more bulky ☐ less bulky ☐ about the same
b. The inflatable is: ☐ more comfortable ☐ less comfortable ☐ about the same
c. In appearance the inflatable is: ☐ more attractive ☐ less attractive ☐ about the same

10. How would you compare the in-water performance of the inflatable with your CG approved PFD? ☐ better ☐ worse ☐ about the same

Comments: _____

_____

11. How would you compare the reliability of the inflatable with your CG approved PFD?

☐ more reliable ☐ less reliable ☐ about the same

12. Did you purchase any replacement CO_2 cylinders? ☐ YES ☐ NO.

* *

Read each statement carefully and place a check (✓) in the appropriate column to the right to indicate your extent of agreement. Please answer every statement. If the statement does not seem applicable to the PFD, answer "strongly disagree." Then repeat the questionnaire referencing your own CG approved PFD and place an (X) in the appropriate column.

	Disagree Strongly	Disagree Moderately	Disagree Slightly	Agree Slightly	Agree Moderately	Agree Strongly
1. This PFD tends to ride up or otherwise be uncomfortable when the wearer is in a sitting or reclining position.	___	___	___	___	___	___
2. This PFD makes the wearer look tense and uncomfortable	___	___	___	___	___	___
3. This PFD would help keep the wearer dry in rain or spray.	___	___	___	___	___	___

	Disagree Strongly	Disagree Moderately	Disagree Slightly	Agree Slightly	Agree Moderately	Agree Strongly
4. Responsible boaters would be willing to wear this PFD routinely while boating.	___	___	___	___	___	___
5. This PFD is easy to put on and fasten.	___	___	___	___	___	___
6. I like the cut and shape of this PFD.	___	___	___	___	___	___
7. If I wore a PFD of this type under normal conditions, friends would probably think I was being over-cautious.	___	___	___	___	___	___
8. This PFD does not restrict my movement or get in my way.	___	___	___	___	___	___
9. If not carefully maintained and checked, this PFD might deteriorate quickly to the point where it would malfunction.	___	___	___	___	___	___
10. I would wear this PFD only in very rough conditions.	___	___	___	___	___	___
11. In a genuine boating emergency, I'd want to be wearing or using a PFD of this type.	___	___	___	___	___	___
12. This PFD can be conveniently used as a cushion or pillow to sit or recline on.	___	___	___	___	___	___
13. This PFD would help keep the wearer warm in cool weather.	___	___	___	___	___	___
14. Adventurous boaters wouldn't wear this PFD.	___	___	___	___	___	___
15. This PFD looks awkward and unattractive on most people.	___	___	___	___	___	___

	Disagree Strongly	Disagree Moderately	Disagree Slightly	Agree Slightly	Agree Moderately	Agree Strongly
16. The color of the PFD matches my boat and/or the clothes I usually wear boating.	___	___	___	___	___	___
17. This PFD fits snugly all around, but not too tightly.	___	___	___	___	___	___
18. I like this PFD because it's reasonably compact or flat.	___	___	___	___	___	___
19. This PFD looks like it would be highly effective in keeping the wearer's head out of the water so he could breathe.	___	___	___	___	___	___
20. This PFD is not excessively hot or sweaty in warm weather.	___	___	___	___	___	___
21. This PFD does not rub, scrape, or pinch the wearer's skin.	___	___	___	___	___	___
22. This PFD does not detract from the appearance of the person who wears it.	___	___	___	___	___	___
23. The expert boater would probably not wear this PFD under normal conditions.	___	___	___	___	___	___
24. This PFD would be reasonably comfortable to wear for hours at a time.	___	___	___	___	___	___
25. This PFD provides good protection from impact with the water.	___	___	___	___	___	___
26. This PFD would not prevent the wearer from getting a suntan.	___	___	___	___	___	___
27. This PFD looks like it would work well even in rough water.	___	___	___	___	___	___

	Disagree Strongly	Disagree Moderately	Disagree Slightly	Agree Slightly	Agree Moderately	Agree Strongly
28. The pockets on this PFD are useful and convenient.	___	___	___	___	___	___
29. If I owned this PFD, I would wear it more than I do the best of my current PFDs.	___	___	___	___	___	___
30. This PFD feels bulky when worn.	___	___	___	___	___	___
31. If I had this type of PFD aboard my boat, I would keep it out in the open so it would be accessible in case of an emergency.	___	___	___	___	___	___
32. If I had a PFD of this type, I would wear it most of the time while boating.	___	___	___	___	___	___
33. Boaters who wear this PFD look confident.	___	___	___	___	___	___
34. The color and/or pattern of the covering on this PFD is attractive. (Rate preferred side if reversible.)	___	___	___	___	___	___
35. This PFD is useful for my boating activities in addition to providing flotation in the event of an accident.	___	___	___	___	___	___
36. Relaxed, casual boaters would wear this PFD.	___	___	___	___	___	___

APPENDIX D - END OF SEASON LETTER AND FINAL
QUESTIONNAIRE TO C.G. AUXILIARY STUDY PARTICIPANTS

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS
U S COAST GUARD G-MMT-3/12
WASHINGTON D C 20590 20593
PHONE
(202) 426-1444

16714/160.001/INFLATABLE
29 NOV 1979

Dear Auxiliarist:

Enclosed is the final questionnaire you will receive in connection with the Coast Guard's inflatable PFD study. Please take the time to fill it out carefully and completely. In particular, make sure you include the test identification number that is hand lettered on the device in black ink. The final questionnaires should be returned to the Coast Guard by 31 December 1979 for your comments to receive consideration.

Also enclosed is an addressed penalty indicia mailing label. This is to be used to return the PFD. All test PFDs must be returned so that we may evaluate their deterioration and perform laboratory tests on them.

Thank you for your participation in this study. The information you have provided will be invaluable in assessing inflatable PFDs for possible Coast Guard appproval.

B E. THOMPSON
Rear Admiral, U. S. Coast Guard
Chief, Office of Boating Safety

Encls: (1) Inflatable PFD Study Final Questionnaire
(2) Addressed penalty indicia mailing label

INFLATABLE PFD STUDY
FINAL QUESTIONNAIRE

PFD Test Identification Number (this number is handwritten on the device in black india ink) _____

1.a. Did you ever go to use this device when you thought it was operable only to find that it was not? (check one)

_____ YES _____ NO

1.b. If yes, describe the event. _____

_____

_____

_____

2.a. What is the highest price you would pay for such a device if it could be counted as one of your required approved PFD's?

_____

2.b. Would you buy this device at that price if it was approved only while being worn? (check one)

_____ YES _____ NO

3. Would you feel put upon if you were boarded and asked to inflate your PFD to show that it was serviceable? (check one)

_____ YES _____ NO

4. Would you wear a device like the test PFD more often than you would your present approved PFD? (check one)

_____	_____	_____	_____	_____
much more	somewhat more	same	somewhat less	much less

5.a. What one feature of this test device do you believe is most valuable?

_____

_____

_____

_____

5.b. What one feature of this test device do you believe detracts most from it.

_____

_____

_____

_____

6. If you had guests aboard who were not familiar with boats which type of device would you be more likely to show them how to use? (check one)

_____ Inflatable test PFD

_____ Your Customary PFD

7.a. Do you trust this device to perform adequately if called upon in an emergency? (check one)

_____ YES _____ NO

7.b. If not, why not? _____

_____

_____

_____

_____

3.a. Is the test device in good enough condition to last another boating season? (check one) _____ YES _____ NO

8.b. If not, do you think it should be... (check one) _____ repaired?

_____ replaced?

9.a. Would you be willing to pay a servicing facility to inspect the device? (check one) _____ YES _____ NO

9.b. Assuming repairs were necessary, would you rather... (check one) _____ do them yourself?

_____ have the servicing facility do them?

10.a. Most people out boating do not wear PFDs all of the time. If you are one of these people, what is your <u>main</u> objection to wearing your approved PFDs?

_____

_____

_____

_____

_____

10.b. Does the design of the test device overcome this objection? (check one) _____ YES _____ NO

10.c. If yes, what aspect of the test device is responsible for overcoming your objection?

11.a. In a short summary describe the one event that made you least favorably inclined towards the test device.

11.b. In a short summary describe the one event that caused you to think most highly of this device.

12. The Coast Guard intends to inspect the test devices to determine how well they have stood up to wear and tear. If the device is still serviceable after this inspection, would you want to receive the PFD back to keep for your private use? (check one) _____ YES _____ NO

Since this is the last questionnaire of the study please feel free to provide any further comments you think should be considered relating to the approval of these devices.

APPENDIX E - TALLY OF QUESTIONNAIRES ANALYZED FOR EACH INFLATABLE PFD BRAND/MODEL

CODE	QUARTERLY	FINAL
A	10	9
B	12	10
C	9	9
D	13	19
E	19	16
F	10	13
G	10	9
H	26	19
I	18	15
J	38	36
K	13	11
L	19	17
M	-	10
N	-	12
O	-	9
P	6	11
Q	-	3
R	-	8
S	-	1
T	-	2
U	-	1
V	-	7
W	-	3

- PFD was not analyzed in Quarterly questionnaire

APPENDIX F - DEFINITION OF TERMS

Design Reliability - The probability that when properly serviced the device performs its intended function when new or after a specified accelerated aging period. This can be measured by performing tests on a new device in a laboratory.

Field Reliability - The probability that the device performs its intended function following a period of actual use in an environment it was intended to be used in. This can be measured in a field test following a certain period of time in actual operation and therefore includes the probability that the device will be properly maintained and serviced.

Wearability - The probability that a device will be worn at the time of an accident which includes normal operations as well as emergency situations. This can be determined by analysing how comfortable the user thinks the device is and how well he or she thinks it will perform its intended function.

Accessibility - The probability that a device will be available to be used or donned when needed. Being able to find the device quickly is important. This can be measured by determining whether the device will be out in the open and also whether it will be difficult to find in storage.

Physical Effectiveness - The probability that the device will properly support the wearer, in the water assuming that the device is inflated. Ease of donning is also included.

APPENDIX G - STATISTICAL TESTS

Four different statistical tests are used to find differences among types of PFD's. The choice of test depends on the number of possible responses to a question and whether a sample is being compared to another sample or an arbitrary characteristic.

1. When the answers are few or are not ordered, the responses have a binomial or multinomial distribution. A test is made to compare the proportion of a response or group of responses.

a. When comparing two samples, the following equation is used, where x_1 and x_2 are the numbers of the specific responses in each sample and n_1 and n_2 are the numbers of responses in each sample.

$$\frac{x_1/n_1 - x_2/n_2}{\sqrt{[(x_1+x_2)/n_1n_2][1 - (x_1+x_2)/(n_1+n_2)]}} > z_{1-\alpha/2}$$

b. When the proportion of a certain response is compared to an arbitrary proportion, the test is to calculate the probability of obtaining x responses from n respondents. The formula is

$$\sum_{i=0}^{x}\binom{n}{x} p^i(1-p)^{n-i} ,$$

where p is the arbitrary proportion. When the probability is less than $\alpha/2$, it is safe to say that p is not the proportion of the population.

2. When there are several possible answers and a mean can be calculated, the distribution is normal unless the responses are grouped closely at either end of the scale of responses. When responses are limited to two or three choices, the distribution becomes more binomial than normal. In that case one of the tests from paragraph 1 should be used.

a. In comparing two samples a preliminary test must be made to determine the probability of the variances of the samples being equal. The variances of the two populations are assumed to be equal if $F_{1-\alpha/2;n-1,m-1} < S_x^2/S_y^2 < F_{\alpha/2;n-1,m-1}$, where n and m are the

respective sample sizes for X and Y, and S_x^2 and S_y^2 are the sample variances.

(1) When the variances are assumed to be equal, the distributions of the PFD's are significantly different if $|\bar{x}-\bar{y}| > t_{1-\alpha/2;n+m-2} s_p \sqrt{1/n + 1/m}$, where the pooled variance

$$s_p = \sqrt{\frac{(n-1)s_x^2 + (m-1)s_y^2}{n+m-2}}.$$

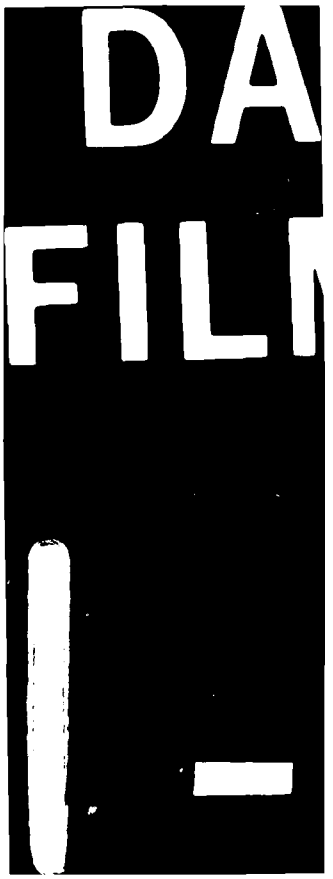
(2) When the variances are not assumed to be equal, the distributions are significantly different if

$$|\bar{x}-\bar{y}| > t_{1-\alpha/2;\nu} \sqrt{s_x^2/n + s_y^2/m}, \text{ where}$$

$$\nu = \frac{(s_x^2/n + s_y^2/m)^2}{[(s_x^2/n)^2/(n+1)] + [(s_y^2/m)^2/(m+1)]} - 2.$$

b. In comparing the mean of several responses of one sample with a fixed number, there is a significant difference if $|\bar{x}-\mu| > t_{1-\alpha/2;n-1} s/\sqrt{n}$, where s is the standard deviation of the sample.

Confidence intervals for the proportions of PFD's of each type which are non-operable are calculated with the following formulae involving the F distribution of ratios. The number of PFD's which were non-operable is k. The upper limit of confidence is $\frac{(k+1)F_{1-\alpha/2;2(k+1),2(n-k)}}{(n-k) + (k-1)F_{1-\alpha/2;2(k+1),2(n-k)}}$. The lower limit is $\frac{k}{k + (n-k+1)F_{1-\alpha/2;2(n-k+1),2k}}$. The non-operable rate is not exactly in the middle of the confidence interval because its distribution is binomial.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